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ABSTRACT

This is a report of congressional hearings that focus on an examination of job forecasting methods to learn how accurately future jobs can be predicted and the kinds of skills and training American workers will need to fill them. Testimony includes statements and prepared statements of the majority leader of the House of Representatives and individuals representing Forecasting International, Ltd.; Massachusetts Institute of Technology; 9-to-5, the National Association of Working Women; Occupational Forecasting, Inc.; Accounting and Financial Management Division, National Productivity Group, General Accounting Office; Bureau of Labor Statistics; Economics, TRW, Inc.; Employment and Training Administration, Department of Labor; Community College of Allegheny County, Pittsburgh; UAW-Ford National Development and Training Center; Oklahoma State Department of Vocational and Technical Education; and Digital Equipment Corp. (YLB)

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JOB FORECASTING

HEARINGS

BEFORE THE

SUBCOMMITTEE ON
INVESTIGATIONS AND OVERSIGHT

OF THE

COMMITTEE ON
SCIENCE AND TECHNOLOGY
U.S. HOUSE OF REPRESENTATIVES

NINETY-EIGHTH CONGRESS

FIRST SESSION

APRIL 6, 7, 1983

[No. 6]

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JOB FORECASTING

WEDNESDAY, APRIL 6, 1983

House of Representatives,
Committee on Science and Technology,
Subcommittee on Investigations, and Oversight,
Washington, D.C.

The subcommittee met, pursuant to notice, at 9:38 a.m., in room 2325, Rayburn House Office Building, Hon. Albert Gore (chairman of the subcommittee) presiding.

Present: Representatives Gore, Reid, Volkmer, Durbin, Skeen, and Schneider.

Staff present: Robert B. Nicholas, chief counsel; Bill Skane, congressional fellow; and Donald L. Rheem, minority technical assistant.

Mr. Gore. The subcommittee will come to order.

I would like to welcome all of our witnesses and guests.

In the last two decades we have witnessed an important change in the way we regard unemployment. In the late fifties and early sixties the words full employment meant just that. We expected unemployment rates of only 3 or 4 percent, as people changed jobs or temporarily left the work force.

But economists in the Reagan administration now tell us that if we succeed in recovering from the current recession, we will be lucky to be able to return to 6 or 7 percent unemployment. That new level, double the historical norm, would constitute a new, virtually permanent group of chronically unemployed people.

Six to seven percent unemployment is hardly what most of us would consider full employment. It means that we are being asked to settle for the loss of the skills of at least 6 to 8 million Americans on a continuing basis. That is a situation I am not willing to accept, and our economy cannot long survive such a handicap.

Part of the reason for this chronic unemployment appears to be structural. There is a mismatch between the skills American workers have, and the available jobs. Some job seekers, we are told, simply do not have the skills necessary for many kinds of employment because they have not been properly educated or trained. And, to make matters worse, in a time of rapid technological change, some jobs in manufacturing or on the assembly line that we once called skilled or semi-skilled are beginning to disappear in large numbers. That means more trained workers may eventually be deskilled and added to the unemployment rolls.

Exactly where these technological changes are leading us is still unclear, but recent actions by two major labor unions give us an indication of the depth of concern. Last year the International Association of Machinists proclaimed a "Technology Bill of Rights" to insure that the workers it represents share in the advances in technology, through education and training programs developed under collective bargaining. Just last week, the Communications Workers of America announced the formation of a committee on the future, to help telecommunications workers avoid the problems of displacement and deskilling that now plague their counterparts in the steel and auto industries.

At the same time, however, we can see a brighter future for jobs on the horizon. The advent of new technologies in energy, telecommunications, computers, biotechnology, and robotics also offers the potential for many new jobs, some of which will not require advanced degrees. They will give us job opportunities, but only if we are ready to take advantage of them. Here, we are not just talking about opportunities for highly educated engineers and scientists. We are speaking about new jobs available to the vast majority of the Nation's work force.

We may be entering an era when few people will be able to count on the skills they learned in school to carry them through a lifetime of work. Experts now tell us that the days of our fathers and grandfathers, when people held one job for a lifetime, may soon be gone. Now, the average person may well change not only jobs, but his or her entire career path one or more times during a lifetime. We need, then, to place greater emphasis on education and retraining for the new jobs our economy will create. For that reason, we must identify what these new jobs are likely to be as far in advance as possible.

For the next 2 days, this subcommittee will examine job forecasting methods, to learn how accurately we can predict future jobs, and the kinds of skills and training American workers will need to fill them.

Job forecasting is about to become an important tool in this Nation's drive to increase productivity at home and remain competitive abroad. It can enable us to better predict what new jobs are likely to be created, as well as how existing jobs will be changed or, in some cases, eliminated by automation.

As we will hear today, ideas about what the future holds for jobs differ widely. According to one estimate, as many as 45 million jobs will be affected in the next 30 years by the rise of new technologies. Some experts predict the creation of large, new industries to service computers and robots. Others worry about the problems of displaced workers losing jobs to machines. Still others believe these impacts have been greatly exaggerated.

Today's witnesses include futurists and occupational forecasters, from both the responsible Federal agencies and private industry. We will be taking a close look at how effective the Federal effort has been in tracking and projecting job change. Tomorrow we will continue with an examination of the critical link between predicting new jobs and developing training and education programs to prepare America's workers for those new jobs.

I am very pleased to welcome as our first witness this morning, the distinguished majority leader of the House, Congressman Jim Wright of Texas.

Before calling on you to make your statement, with your indulgence, Mr. Leader, I would like to recognize the ranking minority member of our subcommittee, Congressman Skeen.

Mr. **Skeen**. Thank you, Mr. Chairman.

With some brief remarks, I think that we should get on with the hearing.

I commend the chairman for holding these important hearings on an issue that I believe is near and dear to all of us, and that is jobs. The issue, as I see it, stems from a twofold process that has already begun and certainly cannot be stopped.

First, the necessity for modernization will create hundreds of thousands of new jobs through this decade.

Second, current jobholders will be subjected to increasing demands for new training as the process of modernization not only creates new jobs, but changes old ones as well.

I am confident that more people will be working at the end of the decade, but the transition of millions of old jobs and old skills to the new skilled jobs could create a difficulty for thousands of workers, unless industry and Government can work together to overcome problems before they occur.

The role of the Federal Government, in my opinion, is not to attempt to predict precisely how many jobs will be created in any number of categories. The Government has tried that and failed in the past. Rather, it is the job of the Federal Government to work with industry in meeting employment needs and to have adequate foresight to make intelligent policy decisions.

I am impressed with the witnesses brought together for these hearings. I think it is safe to say that we will hear from most of the recognized experts in this field in today's and tomorrow's hearings. It is a pleasure to have the opportunity to hear their testimony.

I believe that the administration recognizes the importance of forecasting and retraining, as witnessed by President Reagan's trip to Pittsburgh today to address the National Conference on Dislocated Workers, and I think that he will discuss how existing jobs are changing in the introduction of new technology.

I, too, would like to add a particular welcome to our majority leader—and he is our majority leader—to the subcommittee, Jim Wright. I understand and appreciate his feelings on this issue, and I feel that we agree that jobs to be created will come from the private sector as a result of less Government intervention in the marketplace, not more. Nowhere in the literature on this issue is there any mention of Government-created jobs being a wave of the future.

With continued reductions in Government spending, which I feel will occur by necessity, I am sure that Mr. Wright's and my hopes in this regard on this issue will be met.

Thank you, Mr. Chairman.

Mr. **Gore**. Thank you very much.

Mr. Majority Leader, we are honored to have you as our leadoff witness. Your efforts toward establishing forward-looking training and retraining programs for American workers are well known. You and I have personally had many conversations about this in the past. We are just delighted to have you to lead things off.

STATEMENT OF HON. JIM WRIGHT, A MEMBER OF CONGRESS FROM THE STATE OF TEXAS, AND MAJORITY LEADER OF THE HOUSE OF REPRESENTATIVES

Mr. WRIGHT. Thank you very much.

I want to commend you, Mr. Chairman, and your committee, for the foresight that you demonstrate in probing this very central problem.

It seems to me that the role of Government is to look ahead. The old, shopworn shibboleth is still true that the politician thinks of the next election, while the statesman thinks of the next generation. The way time is compressing, the next generation is often upon us before we are ready to cope with the present one.

It seems to me that it is part and parcel of leadership to concern ourselves with that injunction of Solomon: Where there is no vision, the people perish.

To be ready for each succeeding wave of change—no, not to provide a public job for everybody needing a job at all. I would agree with Mr. Skeen that it is not the role of Government to give everybody a job, nor to see that everyone has everything that he or she needs. It is not the role of Government to say that we, as a country, owe everybody a living.

However, I think in a country as wealthy and as intelligent and as blessed with foresight and knowledge and skill as ours, we as a society do owe to the humblest of our citizens a very real opportunity to earn a living. With that in mind, I think we need to lay a very brief predicate, by examining some of the realities of our time.

One of those is the fantastic compression of time, which has shrunk the planet Earth until today, for purposes of transportation or communication, either one, the average citizen out in Frederick, Md., let us say, is a lot closer to London, Paris, Moscow, Saigon, or Beirut than he might have been 100 years ago to his own State capital at Annapolis. You think about that.

Another of the overwhelming realities that inundates us, and sometimes intimidates us, is the manner in which science and technology have sped ahead at such a blinding pace that they have, as the chairman has just said, threatened to leave behind the knowledge, which was so precious to us, only a decade or so ago.

We see now the phenomenon increasingly of people in midcareer left destitute. These are not untrained people. They are not uneducated people. Often they are very well-educated people. Quite frequently, they are highly skilled individuals, trained with skills honed in the marketplace to meet needs that existed at the time they were trained, with reasonably high levels of income, with every expectation of a secure future and upward mobility. Suddenly these people in midcareer, perhaps in their early forties, find themselves thrown out of work, through no fault of their own, simply because technologies have changed and because there no longer is a demand for the particular skills that they individually possess, and to which they have been trained.

I find this in the highly vaunted Sun Belt, where I live, where Mr. Skeen lives, where I think the chairman lives. We find increasingly greater numbers of people in those centers and magnets of employment, which had attracted people to our areas.

The General Motors assembly plant in Arlington, Tex., which was in my district, and is now adjacent to my district, a year or so ago laid off about 1,200 people. The Bell Helicopter plant, which had grown and grown until it was employing some 9,000 people in 5 locations in my immediate area, in the past year has had to lay off as many as 3,000 of those 9,000. These are highly skilled individuals, as were, indeed, many of those who were associated with Braniff Airways, which, of course, had to take bankruptcy and which has dispossessed some 5,000 or 6,000 very skilled people.

These stories are not exclusive to my area of the country. I know that they are simply illustrative of what is happening all over the Nation.

What can we do? It seems to me that we have the responsibility, as a Government, as leaders, as those who are trying to create a climate conducive to the best possible utilization of our skilled manpower and womanpower and the most rapid economic development, to pull us out of the slough of recession in which we have found ourselves, to try to provide some intelligent direction, not to usurp private business certainly, but to work with private business to attempt to provide some of the tools that no individual private business can provide for itself.

One of those tools, it seems to me, would be a computerized job bank, probably in the Department of Labor, calling upon the resources available to the Department of Labor and to the Department of Commerce, through its multiplicity of reports, which it exacts from the business community throughout the United States, to see if it can have some reasonably accurate picture forecast for the next 6 months, let's say, of precisely what skills and just what jobs the American business community expects to have available, what kinds of skills it intends to try to find in the marketplace 6 months from now.

Then into that kind of a computerized data bank, it seems to me, it would be a reasonably simple matter for the local employment offices throughout the United States to gain an accurate picture of just what kinds of skills are likely to be needed, in what numbers, and where. Then perhaps we might be able to mobilize that great resource which exists across our country in the network of community colleges, so as to craft specific types of training programs aimed at making these newly unemployed people, people with kids getting ready to go to college, employable again.

These are not stupid people. They are not untrainable people.

Most of these jobs in the marketplace are not jobs that require a college education. They do not require a degree. They do require training.

Here is today's Washington Post. I have from time to time tried to look in the help-wanted section and imagine myself suddenly unemployed, and wonder what kind of job I would qualify for, and just which of these ads I might answer. I find it somewhat frustrating, a very humbling experience. I recommend it to the rest of us, because I find here many for test technician seniors, telephone technicians, WangLexitron-NBI 3000 contemporaries, word processing managers, word processors, Wang operators, CT specialists, radiographers, Lanier-Lexitron operators, word processing teachers, and so forth.

There usually are a few I think I might qualify for. There are some here that say waitress but they don't say waiter. Yes, here's one that says waiter or waitress. I could possibly do that.

There are some that say typist. I am not that good a typist. They always want some good typist.

I found one one day that said landscape architect. Now if that means a yard man, I can do that.

However, most of these jobs that exist are jobs for which I would not qualify, and I think that may well be true of people who are more highly trained and skilled than I am, in other technologies which now go begging.

Ironically, the Congress directed in 1978 that just such a system be created, and it is a mystery to me that it has not been done. Apparently, Public Law 95-524, signed on October 27, 1978, has been largely ignored by the Department of Labor. That law directs in section 312(a) the Secretary, meaning the Secretary of Labor in this instance, "shall develop a comprehensive system of labor market information on a national, State, local, and other appropriate basis, which shall be made publicly available in a timely fashion."

Subsection (f) is even more specific. It directed that:

> The Secretary shall establish and carry out a nationwide computerized job bank and matching programs, including the listing of all suitable employment openings with local offices of the State employment service agencies by Federal contractors and subcontractors, and providing for the affirmative action, as required by section 2012(a) of Title 38, U.S. Code, on a regional, State, and local basis, using electronic data processing and telecommunication systems to the maximum extent possible for the purpose of identifying sources of available persons and job vacancies, providing an expeditious means of matching the qualifications of unemployed, underemployed, and economically disadvantaged persons with the employer requirements and job opportunities and referring and placing such persons in jobs.

If a serious, concerted effort has been made to carry out that directive, I am unaware of it.

In only a slightly less direct and explicit way, Congress provided, only last year, in the conference report on the Job Training Partnership Act, 97-889, in section 462(a):

> The Secretary shall develop and maintain for the Nation, State, and local areas current employment data by occupation and industry based on the occupational employment statistics program, including selected sample surveys and projections by the Bureau of Labor Statistics of employment and openings by occupation.

Now this, of course, was our job training effort that we passed last year, and which the President embraced after it had gone to the Senate and publicly endorsed. The public law which I mentioned to you earlier was passed in 1978. That was a job training program, too, directing that the Secretary should conduct educational and assistance programs of various specific types.

Now, those things can be done, I am convinced. I think the technology exists to perform them. However, because they are not being done in a centralized or organized way, we see springing around the country, ad hoc efforts to achieve on a localized basis what ought to be able to be achieved in a much more scientific way.

Here is a clipping from a newspaper of the past 2 or 3 days, reporting that thousands of unemployed Arizonans jammed telephone lines during a statewide jobathon television program that generated nearly 3,000 jobs, far exceeding the original goals of 1,700 jobs. I gather from that scant reference that it means it placed that many people in existing jobs. These were simply people who could not find jobs.

Believe me, there are people who have made serious efforts to find jobs, and have been repeatedly disappointed, buffeted against the grains of the disappointing wall of denial.

I talked with a man who had been laid off from the Bell Helicopter Co., who reported to me that he had personally presented himself at 114 separate employers, places of business, offering his services. He had not just answered that many ads; he had not sent in that many resumes; and I am not sure that all of these people necessarily were listed with the Texas Employment Service as needing somebody. He had gone around actively, personally looking for work—114 different places he had been. That man wants a job.

Recently, when I was returning to my district, as all of us do with some frequency, I recognized a man whom I had known as a middle-level executive at Braniff, now defunct. He had been upwardly mobile, a man in his, I would say, most productive years probably, in his midforties, a man of some distinction, some refinement, some training and education. He was wearing a uniform of a porter and carrying bags at the airport. He did not feel demeaned by that. I stopped and engaged him in conversation because I know him. He said he felt lucky that he had found a job at all. This was surely not a highly skilled job, as you would know. It requires a certain amount of physical exertion and effort. It paid him considerably less, obviously, than the job that he had had as an executive with Braniff. This is the kind of thing we have out there in the American society.

I am sure that any of you who go back home to your districts and make a practice of going down to the employment offices have seen, as I have seen, the real despair that exists among some of the people today.

I did this recently on a trip home and discovered, to my real shock, the degree of absolute need and near desperation that exists among people who have been long jobless.

I encountered some people who stand there every morning in front of the employment office waiting for someone to come by and offer a day's work, just 1 day's work. One of those people I engaged in conversation. I asked him if he were signed up inside for a regular job, and he said, "Oh, yes, absolutely. I have been for months," but he said, "The difficulty is if I were to receive a job today which paid me 2 weeks from now or a month from now, I don't know what I would do, because if I don't get paid today, I can't eat tonight."

I talked with another fellow who said that he had normally been getting a job about 2 days a week, some weeks 3 days. There would be someone come by and offer him a day's work. However, he had not had a job offered to him that week, and he said, "If I don't get something today, I'm going to have to go back down to the Texas blood fractions and see if I can sell another pint of blood." Seven dollars is what he gets for a pint of blood at that place. He said it had not been quite 2 weeks since he had done that, but maybe they would permit him to do it again. That is the measure of the desperation I am talking about.

We have seen the reemergence in the American society of homeless people, people dispossessed from their homes by their inability to meet their mortgage payments, having lost their jobs, some of them adrift upon the moving tide of the American economy, going around looking for some place to land, some place to work.

In most of our cities, we have seen the reemergence of soup lines. I think there are some 58 or perhaps more places in my community of Fort Worth, which provide feeding of one kind or another, a free meal. Most of them are churches or other church-related institutions.

I went to some of those. The priest at a place called Loaves and Fishes, where magnificent, fine young people volunteer their time to offer service and food to hungry people, pointed to a young couple in a line waiting to go into the church at about the noontime period for a lunch that was provided, and he said, "Where would you suppose that young couple sleeps at night?" Of course, I had no idea. It was a nice-looking young couple. They looked like they were maybe in their early thirties. He pointed to a culvert, a cross section of concrete pipe maybe 6 feet in diameter and perhaps 10 or 12 feet in length lying in a lot adjacent to the churchyard, and he said, "That's where they have been sleeping at night."

I saw another man, who said that the agencies that customarily provide emergency shelter, such as the Union Gospel Mission in my town and the Salvation Army—both of them, because of the great numbers of dispossessed people, had been forced to adopt an arbitrary rule to the effect that you might stay on three successive nights, and then if you were not able to provide $3, you must move out and let somebody else come in and take those limited spaces.

I asked this chap where he had spent the night, and he said in a boxcar over at the T&P tracks. I asked him if anybody else was in the boxcar. He said, yes, that there were five, I believe he said, that spent the night in that particular boxcar.

All I am saying to you is this: We are a nation that has conquered problems. We are the Nation to whom John F. Kennedy in 1961 pledged, in his state of the Union message, that we would have a man on the moon by 1970. The sheer audacity of that challenge arrested us, and shocked us out of our lethargy. Nobody knew how that could be done, but it was done because we gave it enough priority.

This job, too, can be done. There is no doubt in my mind that we have the capacity to identify the kinds of jobs that are going to be available on the American marketplace, and to provide the types of training that will qualify our work force to fill those jobs. If we do not do it, it is just because of our unwillingness to give it sufficient priority.

Mr. Chairman, I have already talked longer than I had intended to, and I apologize to you for that.

With my grateful thanks for your having given me this opportunity to share these scattering thoughts with you, I would be glad to respond to any questions that you might have. Otherwise, I will vacate this place for some better qualified person than I.

Mr. **Gore**. Well, it is we who thank you for getting us off to such a good start.

We will be hearing, throughout these 2 days of testimony, that there are both short-term projections and long-term projections of the impact of technology on the job market and projections of what jobs are likely to be created.

Your call for this Nation to create a national computerized job bank which is capable of listing occupations needing to be filled, and jobs needing to be filled at least 6 months in advance, I think, is a most appropriate way to begin these hearings.

We will be questioning the Department of Labor about the sharp difference between their responsibilities under the law, as you cited, and the performance which has been sadly lacking, and we will try to find out why those mandates in the law have not been fulfilled.

In that process, we will find that there is great difficulty in projecting even 6 months in advance. We will hear from other witnesses who will tell us it definitely can be done.

The solutions for that short-term projection will, I hope, help us in the effort to craft better long-term projections. Therefore, I think your testimony is a most appropriate way to begin.

If we do not begin and if we are not successful, the personal tragedies which you cited in your testimony as examples of what is happening in this country could become much more numerous in the decades just ahead.

Congressman Skeen.

Mr. **Skeen**. Thank you, Mr. Chairman.

I will not belabor this any longer. I just want to commend the majority leader, a gentleman whom I respect, and I always have a great interest in what he has to say. No matter what he says about the want ad columns, I think it would be a good experience for every Member of Congress, these 435 extremely important people who sit around here and work every day, to go back and read those want ads. It would be a very humbling experience, and a pinch of that humility would not hurt this institution at all—and maybe even on the Senate side. [Laughter.]

Mr. **Wright**. Every now and then, the public gives us a mandate to go back and read those want ads.

Mr. **Skeen**. It does. I think, particularly in the case of the House Members, they ought to on a periodic basis take a look at those and see what their qualifications might be.

I think particularly the key word was "opportunities." We have a wealth of opportunity in this country, if we can exploit it. It is there, but it is all based on our productivity. We have forgotten that we have to be a nation that rides and stands on its ability to produce.

Both poor management policies in the private sector and bad Government policies have somewhat reduced our ability to produce and provide new jobs. There is, however, hope because we are adaptable. We are flexible. The human being is the most adaptable creature on this Earth. They can do almost any task or any level of tasks. I think that is what we are talking about today: Do we recognize the fact that we are in transition?

We, as people in Government as well as those in the private sector, have to adapt and become flexible. Do we recognize the fact that once you are trained in a particular profession, that does not mean that you will stay in that profession forever; that you need to stay current, to change, to increase your expertise in a particular field. I think you illustrated that very well.

I want to commend and thank you very much for it.

Mr. GORE. Incidentally, with all this discussion of humility, Mr. Leader, I found an opening here: "Wanted: high-powered Washington lawyer-lobbyist with demonstrated leadership ability in Capitol Hill, $250,000 per year."

Mr. WRIGHT. Where do you apply for that? [Laughter.]

It would be just my luck they would say "under 40." [Laughter.]

Mr. SKEEN. Would they mind coming up here to interview? [Laughter.]

Mr. GORE. Congressman Durbin.

Mr. DURBIN. I want to thank the majority leader, too.

It is interesting, being from the Midwest where we are hit so hard, to hear testimony from Texas, that it is a shared national experience. One of the things that has always concerned me about the idea of a national computer bank is facing my 52-year-old unemployed automobile industry worker who has a home and suggesting to him that somewhere in the State of Washington there is a possibility if he will pick up and move.

As Mr. Skeen has mentioned earlier, we are very flexible and adapt as human beings, but some of the dislocations which we would ask people in those circumstances would be substantial. They hate to walk away from a lifetime investment in a community, whether it is in the Midwest or in Texas, to move off to some other area. It could be that as we address making the information available, we also should address the possibility of easing the transition. I think that is something that we should be considering in the Congress.

I commend you for your testimony.

Mr. WRIGHT. Thank you very much.

There is no question about what you say. While we try to identify where the jobs are, maybe also we need to be identifying where the unemployed people are and have an extra head of steam behind some of the already available tools, the machinery, that we have allowed to rust and go idle. We are trying to create opportunities for investments in job-creating enterprises in those areas where people live and are out of work.

Mr. GORE. In that regard, Mr. Leader, I saw a news report about a man and his wife in Detroit who every Friday rent a truck and drive the long distance to Houston, Tex., and fill it up with Sunday newspapers and drive all the way back to Detroit and make a pretty good bundle of money each week by selling those Sunday Houston newspapers on the streets of Detroit. Surely, we can figure out a way to give the people who are buying those want ads so far from their homes a little better notice of what is likely to happen in the job market and a little better idea of what they might be able to do to prepare themselves for the changes that we know are coming.

Once again, let me thank you for the honor you show us by coming and kicking off these hearings for us. Thank you.

Mr. WRIGHT. Thank you very much.

Mr. GORE. Our next witnesses will appear as a panel. The first panel on job forecasting is made up of: Marvin Cetron, a well-known futurist and author who has written extensively about the jobs of tomorrow; Paul Strassmann, vice president of the Information Products Group at the Xerox Corp., who has studied the impacts of new technologies on the economy; Harley Shaiken, a researcher in the program in science, technology, and society at the Massachusetts Institute of Technology, and specifically its laboratory for manufacturing and productivity; and Judith Gregory, the research director for 9-to-5, the National Association of Working Women.

If all four of you would come to the witness table, I would like to welcome you in behalf of the subcommittee.

Without objection, the prepared statements of all of you will be made part of the record.

We would like to begin with you, Mr. Cetron. We appreciate your attendance here today and look forward to your testimony.

Please begin.

STATEMENT OF MARVIN CETRON, PRESIDENT, FORECASTING INTERNATIONAL, LTD.,

Mr. CETRON. Thank you very much, Mr. Chairman and Congressmen.

I was going to entitle the paper not "Jobs with a Future," but "Jobs is a Four-Letter Word," because there is a mismatch between how we are training people and what is actually happening.

First, I think we ought to be honest and admit that there are 11.2 million people unemployed. If the recession were over, tomorrow 1.2 million of those would never get their old jobs back again. I think politicians are embarrassed to tell their constituents; labor leaders don't want their worker to take lower paying jobs; and corporate people want to hold out the idea that jobs will comeback.

As the Congressman from Illinois said, four out of five work areas will affect Illinois. The five areas are steel, automobiles, rubber, textiles, and railroads. In those particular areas there are roughly 1.2 million jobs that just are not going to come back, period. It would not matter if Reagan, Carter, or Franklin Roosevelt were President those jobs are technologically displaced, two-thirds of them because of automation. That is robotics, numerically controlled equipment, computer-aided design, computer-aided manufacturing, and flexible manufacturing. About one-sixth will be replaced because of dumping, nationalized industries overseas such as the steel industry in Britain, et cetera, and about one-sixth because of low wage rate countries with which we cannot compete. We are talking now specifically about places like Thailand, Pakistan, Bangladesh, et cetera. The workers are making $182 a year. We just cannot compete with those rates.

These people are just not going to get those jobs back. Someone ought to say, "Look, you've got to be retrained."

I was very pleased to find out that the President was going to Pittsburgh today to visit Control Data Institute and look at steelworkers, 125 of whom are being trained to be computer technicians, computer programmers, and in some cases computer analysts. These are people who were steelworkers whose grandparents worked in the steel mills, whose parents worked in the steel mills, and who left school when they were, say, in 10th grade, took a job and expected to live the American dream. It didn't happen that way.

I am glad Jim Wright brought up the point of taking a look at the Washington Post and the job areas found there. I am sure we have heard twice, last year and about 5 weeks ago, that the President said, "There are 26 pages of jobs in the classifieds." I looked at and analyzed those 26 pages. Twenty-four of those pages were high tech. Two pages were for Burger Chef and McDonald's. Of those 24 pages of high tech, roughly one-third were professional. You have to have a college degree in math, chemistry, science, or engineering, et cetera, but almost 18 pages were not. They were technician jobs. These are the kinds of jobs that he was reading off. They are there. There is a mismatch between the people we have trained and those who get the jobs.

We have gone into more detail about what is happening, and my testimony covers a lot of that.

However, we have to realize that everybody talks about the service sector. We are going from 4-percent in agriculture to 3 percent in agriculture, and it looks like 15 percent of our farmers the small farmers are going to lose their farms. There are going to be big agribusinesses running them. There will be more productivity, we will get more out of it, but that means there are going to be more people who are displaced in the long run.

You are talking, in the area of manufacturing, about a drop from 28 percent to between 11 and 8 percent, depending on whether or not we go robotic in a big way and whether or not we go to computerization of the office of the future. This means you are talking about 88 percent of the population being in the service sector by the year 2000, half of which will be in information areas. I am sure Dr. Strassmann from Xerox will cover this later in his area. Specifically, half those people could be working at home as well. Therefore, you are talking about a major shift in what is taking place now.

I think we have to get to the point of saying, look, what are we going to do and what is coming out? What kind of guidance are we getting from the Department of Labor? To be very honest, I would like to be able to say it is GIGO—"Garbage In and Garbage Out." It is worse. It is Garbage In and Gospel Out, because it has the seal of the United States on the cover, and it is not good data. It is old data. With all due respect to members on the panel, they are like lawyers—they are looking in the past, not in the future, basing it on past precedent.

You have to look at what is happening in technology and say this is where the jobs are going to be.

One of the things that has happened between 1970 and 1980, is an 85 percent increase in productivity in the factory because we spent roughly $100 per worker in the factory. We have had less than a 4-percent increase in the office of the future because we put between $5 and $10 per person into the office.

Everybody is aware that robotics is coming in a big way. We know that we are going robotic because we have no choice. We are going robotic because the Japanese are going robotic. They are going robotic because they had no choice. Between 1985 and 1990 20 percent of the Japanese work force will retire at 80 percent of their base pay. They had to go robotic. They started 10 or 12 years ago.

A robot that now costs $150,000, by 1985 will cost $35,000, and by 1990 less than $5,000, the price of a car. It is much less than the price of the fringe benefits package of an automobile worker and the robot can replace six workers. A robot does not put out 15 percent scrap; it puts out less than 1 percent scrap. It uses only 60 percent of the paint that is being sprayed on an automobile. I am just taking a couple examples.

What I am saying is that we have major changes taking place.

The group in the office of the future is not going to get away unscathed. There are machines that are being used in the military, at NSA, to monitor all the telephone calls going overseas, that now can be used by individuals. There is a computer, a 6,000-word Lexicon that you can read a list of words into for an hour and a half. After words you can use those words in context, the computer will type up to 92 percent of what you said correctly. You can correct the words that you slurred, and the text will be 97 percent correct. This means that in the next 10 years, roughly one-third of our typists, stenographers, and people who take dictation, that is typing pools are going to be replaced by computers.

Also, some of the people in the factories are going to be replaced. It will be the typists who are able to use word processing equipment who will control the robots. You do not need skill or brawn. The pink-collar worker becomes the blue-collar worker controlling the steel-collar worker. It is a major shift, and I do not think we are prepared for all of it.

What I am saying, in essence, is that we have to get to the point now where we say, "OK. What are we going to do? What does this mean?"

You gave some numbers before between 3 and 4 percent, Al, about the problems of unemployment. The truth is up to 2 years ago we were even willing to accept 4.5-percent unemployment as being full employment. The truth is it is not going to be 3 or 4 or even 4.5 percent. It is going to be closer to 8 or 8.5 percent because you are going to be talking about 3 percent of the population being in training programs at all times. Every 10 years you are going to go back and retrain.

With all due respect, it also does not mean throwing at a program. Throwing money at a program is not an answer. The CETA program did not work. Sixty percent of the money was used for administration; 40 percent for training. Less than 3 percent of the people got jobs.

Until 1979 we trained manual elevator operators. That was crazy. Linotype operators—a linotype operator has not been hired since 1969. These people are standing next to the optical character readers, but we trained them until 1978 because it gave people jobs. That is not an answer.

It is the old biblical business—you don't throw money at a program. You do not give a person who is hungry money. You do not give them a fish; you give them a fishing rod and train them how to fish. We are saying the same thing with different terminology today. High tech is here, and we have to get into that.

Now there are not going to be as many jobs in the future. That is a fact. However, it does mean that if we start looking at it in a meaningful way, we can job share.

If six people are replaced by a robot, in one of the appliance factories or one of the automobile factories, four can keep the job. Each will work a 20-hour work week, get paid for 40 hours, and still get a 50-percent increase in productivity because the robot is producing what six people would do. It means the person can also go out and buy the product. If we do not do this, we are going to be in trouble.

Information processing is no different across the board. Job shifting is going to come in. Job shifting means that in 1980, for instance, 45 percent of the spouses and partners were both working. It will rise to 65 percent by the year 1990. By the year 2000, in 75 percent of families both spouses are going to be working. This means blurring of sexual roles not only on the job, but at home as well. It means something else. You are going to have to get retrained right now. By 1990, the bulk—I would say over 95 percent—of the work done by engineers can be done by computers. It can be put in. It cannot be done for physicists, mathematicians, chemists, et cetera, but for engineering, I say, yes, because that is my background. My undergraduate work was in engineering. The computers now do a better job than I did when I graduated in engineering because the information is there.

We are talking about getting retrained every 10 years. It will not be that difficult if both partners are working in most cases because it takes 2 to 3 months to get retrained.

There is a good reason for it. Up to age 21, we learn a trade for professions. From 21 to 25, we learn the tricks of the trade, the informal chain of command, "he who hath the gold maketh the rules," how do you make your boss think he thought of the idea first? We learn those tricks. Between 25 and 35, we practice the trade with the tricks of the trade. After 35, we have forgotten the trade and we are practicing tricks. [Laughter.]

The trouble, very simply, is we have to go back so that we understand. What is happening here is if we go back every 10 years, it means every 5 years the husband, the wife, or the partner will take off and get retrained.

Right now the average individual gets "10 jobs before he is 30 years old and then 1 every 10 years." That is one thing. Job sharing is going to come in. He is going to be working shorter work hours, with more productivity from everybody.

I am not going to go through the roughly 15 pages of new jobs. We have talked about the new jobs, new technology, how many jobs are available, starting salaries, midcareer salaries, and new types of training. It is in the paper. You can read that. I will read the headings off to give you some examples.

One of them is energy technician. We need many of these people. We are wasting energy; energy is a problem area, and water is going to be a critical problem area in the future, fresh potable drinking water, especially for the Midwest and the sagebrush area.

Our worst problem in the future is not going to be energy and it is not going to be water. It is going to be our kids. We are not educating them properly for these new jobs. That is the worst problem we have. We will address that in a few moments.

Energy technician is one new job. We have about 650,000 jobs required in this area, earning $13,000 per year to start and about $26,000 in midcareer or in about 10 years.

Housing rehabilitation technicians—there is no reason that we do not go back to the people—we talk about the ghettos in the city. We have over 40 percent unemployment for the black youth in our cities right now, with many of them living in public housing. There is no reason they should not get trained as housing rehabilitation technician and learn how to, take care of boilers, caulk the windows, wallpaper, and repair the plumbing and electrical problems. Get these people to work and then send them out as a corps to fix other people's houses that need this sort of thing. We are doing nothing in that area, and that is just another example.

Hazardous waste management technicians—you understand well what I am talking about. We need 300,000 of these people, with a starting salary of probably $15,000, and an average of $28,000. These are all technicians. These are not professional jobs. We are talking now about industrial laser technicians, material utilization technicians, industrial robot technicians, genetic engineering technicians.

My son is at the University of Utah where they are working on the artificial arm, the artificial leg, the artificial hand connected to the arm, artificial spleens, organs, hearts, et cetera.

More people are required not only doctors with advanced degrees, but paramedics, emergency medical technicians, and people who can work with the equipment itself such as the CAT scans. We need people who can read the CAT scans to prevent some of the operations required, for instance, when you have to go in for a frozen section or for a biopsy. That can be done by taking a look at some of the CAT scans and PET scans. We don't have enough people coming out in these areas. We need paramedics, emergency medical technicians, midwives, and biomedical technicians. We have about 23 or 24 listed in my testimony as examples.

Basically, computer-aided design, computer-aided graphics technician, computer-aided manufacturing—these were generated with Clyde Helms from our organization. Clyde is going to be testifying later in some detail on the training for those individuals.

However, I want to get through a couple of things that I think are more important, that is, some solutions, long term and short term.

First of all, we all look at the Route 128 complex in Massachusetts and say that is where the high tech is, that is what we have to look like, or Silicon Valley or the research triangle down in North Carolina. In almost every one of those cases you need three things. One, you must have a very good university or at least a couple of universities producing information and professors who can make themselves available to the local industries. Second, you must have a good program so that graduate students can be the slave labor used in the area. They do not make enough at school, so they work outside in the service sector. The reason you keep the students after they graduate and you can attract students to the high tech areas—I am talking genetic engineering; I am talking about robotics; I am talking about Silicon Valley, et cetera, in this areas—is that you have a good school system.

Our school system is getting to be pitiful. Teachering is now the curriculum of last resort. We just are not educating our teachers well. Some of the Congressmen here can look at the salaries. Basically, what I am saying is that it is very, very poor. The average teacher needs an increase of a minimum of 20 percent, so they can compete.

Right now it is considered low salaries and over supply because during the baby boom we got too many people involved there. We were very fortunate. We finally opened up a lot of the jobs to females. It used to be, before World War II, the only profession was teaching. The only subprofession was nursing, practical nursing. Now women can go into everything. Therefore, the people we used to get that were really good and committed to excellence are no longer going into teaching. They can get much more money some place else. The math, the physics, the chemistry, the science teachers, the vocational education teachers we really need, they get a 50- to 60-percent increase when they leave and go to work for a private firm. There is no reason for them to stay in the school systems. You have to give a 40 percent increase to math, physics, chemistry, science, and vocational education teachers locally to make sure that you are going to get the people, because our scarce resource, again, is kids.

I blame the Harvard Business School. In the case study it says, "If it doesn't happen on my watch, I'm not about to fund it," or what we call the "bottom line." The bottom line says we do not fund research and development, we do not fund education, and we do not fund training, because they all have a long-term payoff. That is exactly what we are doing. We do it in corporations. We do it in government. We do it back home. If things get tough, we just withdraw in areas that have a long-term payoff, and it is a shame.

There is no reason that the smokestack areas of Michigan, Ohio, western Pennsylvania, and Indiana should not be the robot capital of the world—none. They have the capability; they have the places to use the people, but they are giving it lip service. Everybody is giving it lip service.

We gave away our technology in the transistor once before. Now in the microchip area there is no reason for us to have something like NTIS, the National Technical Information Service, where we are going to be competing in the future, giving everything overseas. We not only give it overseas, but we give them keywords, we structure it for them. The Russians get three copies of every single thing going out. They do not do the research in most cases. They buy it from us. They get it for $3.50 a document.

There are some things that have to be done also to make the teaching profession more of a profession, if you will. I think we ought to start saying, "Look, you have to have a minimum SAT score, scholastic aptitude, of at least 850 before you can be accepted into a teaching school. Second, I think it is crucial that at the end of your sophomore year, just as we do for business school, engineering school, law school, and med school, if your grade average is not a 3 or 3.2 average, a B average, you cannot go and be a teacher and teach our kids. You are dealing with something very precious to us.

In addition to this, I think there ought to be a test when they graduate, just as we take an engineering certification exam, which I took, and I am sure everybody else did, and a bar examination, et cetera. They have to take an examination. That is only the beginning.

If they do not take a minimum of two courses in computers and become computer literate, they should not be given a job at all. The reason is because we are competing. A computer is going to be just like driving a car in the future, even more so, because it is going to mean the difference in getting a job or not.

I was in Detroit and gave a major briefing to a women's group called Strategy. There were 8,000 women. There were 4,500 young high school juniors the day before from the whole Detroit area. We were talking about technology being a great equalizer, and it is.

You find more and more women now in the philharmonic orchestras because they take their test behind a screen, not wearing high heeled shoes, and when you just go by what they play, they get the jobs. That is true in high technology areas also. It opens up a lot of other areas for people.

However, it also means that the computer is here. Because the computer is here in this educational area, if the kids know more than the teachers do about computers, we have big troubles and most of the kids know more about them.

Teachers ought to be given 4 years to become computer literate. I am not talking only about the Apples, the Ataris, the TRS 60's and TRS 80's, the CDC 111's. I am talking about training, not just education. I mean the Plato machine is interactive. You can teach a person in 2 to 3 months. That is what the President is looking at today in Pittsburgh.

You do not have to be able to type. Some people do not have the capability to learn how to type, but they can work directly on the interactive screen and learn how to be a robot technician or take care of computers. This is what we need to get people in quickly, 2 to 3 months, and get them a job.

In addition, a person who is unemployed—there is a very good analogy, and I do not like to use it but it is a good analogy. It is like a person being divorced. The first thing is, Why me? Why me? The second thing is, Well, it isn't my fault. I'm going to stay there until they call me back, they being the spouse or they being the corporation.

The problem we run into, of course, is that we are not going to get called back. The worse thing we could do, although it looks like a good idea at the time, is for the spouse to say, "Look, I'm going to come back and spend some time with you and make it easier."

It is like the automobile firms that went out just before Christmas and said, "We're going to give you $300 so that you can buy toys for the kids and you can buy yourself a ham or a turkey before Christmas time." On the face of it, it looks great, but the

$300 per person—the toys are broken now, the food has been eaten, and that $300 per person came from training funds, and people were not being trained. That is one quarter of the training funds to get a person trained, $1,200. It just does not make any sense. It is like a person going back home.

It is difficult for people that are 45 and 50 years old, to go back out and compete with the youngsters. An older woman going out and competing in the meat markets with the young gals has a difficult time. An older guy going out and competing with a young kid has a rough time. It is the same thing for jobs. It is not easy, but we have to do it.

We are adaptable, as you have said before, but it means getting ourselves in and doing the job.

I talked to the young gals out there, about 4,500 high school seniors. Eighty percent of them were looking for education, not for knowledge to provide them with a good job. This is a major shift. We have had it since the thirties like that.

I told the gals out there, any one of you who is expecting some white knight to come charging in here and take care of you for the rest of your life is in big trouble, because you are going to be only one person away from being on welfare. Women have to get trained in professions. When women hold jobs, they cannot be considered female jobs that are going to have 20 percent less pay than the same jobs held by men.

I think high technology is a great equalizer. It is a tremendous area for opportunity for women.

Really what I am saying is that a harmful attitude pervades this country. The school systems are dumping money into new stadiums instead of computers, into new playgrounds instead of computers. They give letters in football, basketball, and track. There is no reason why we should not have letters being given to a kid who is a mathlete or a chemlete or a physlete. If he is on all three teams, give him three letters. I see no reason to have the attitude that we have to take care of any person who does well in the athletic area and gives them scholarships. We have to start competing in the math, physics, and chemistry areas.

We require between 1 and 2 years of mathematics for a high school graduate. In a high-tech society, the Japanese require 6 years of math to graduate from high school, and the Russians require 7½ years, including calculus and differential and integral equations to graduate from high school. How are we going to compete in the future in this area? I think we have some major problems that we have to address. We should also go to school 7 hours a day, not 6 hours, and 11 months, not 9 months per year.

As I said before, I am not going to go through all the information discussed in my paper.

The microchip is replacing us in the robotic area. It is doing the same thing with computers in the office of the future, that microchip and these techniques I mentioned before. That is why I mentioned the interactive screens that Control Data's Plato has. That is the way to train people, use the microchip to help us.

We are talking in terms of people working shorter work hours, between 30- and 35-hour workweeks by 1990 and a 20- to 25-hour workweek, getting the pay we do now for 40 hours because productivity goes up—it is not a question of saying, "Let's divide the pie differently." It is, "let's make a bigger pie." I think the computer chip makes that increase in productivity available.

Thank you very much. I will take any questions you may have, gentlemen.

[The prepared statement of Marvin Cetron follows:]

JOBS WITH A FUTURE

By Dr. Marvin J. Cetron
President, Forecasting International

Let me start out by saying forecasters are not futurists, who often operate by predicting events they would like to see come true. Forecasters use trends and yardsticks and computers to measure the likelihood of an event taking place. Their yardsticks include technical and economic feasibility, in other words, will it work and what will it cost? They also include social and political acceptability. Will consumers accept it? Will Federal and state regulations slow it?

Futurists have forecast the advent of solar energy. Why? Because it's clean and unlimited. They ignore its cost, which is out of sight even alongside $50-a-barrel oil. All right, now let's apply our trends, our tests and yardsticks to tomorrow's job markets. We know that major employment shifts will soon take place, we know that smokestack industries are dying out and we know that high-technology industries are being born. We know that more women will be working, we know people want to work shorter weeks, we know more education and higher skills will be needed to win and hold onto the jobs of the future. How can we use these trends to forecast the jobs of the future?

We know that robots will soon take over steel and auto assembly lines because they have already begun to do so. We know that automation has eliminated jobs in the railroad, textile and rubber industries, jobs that have disappeared forever. Heavy manufacturing will comprise only 11 percent of the jobs in America by the year

2000, down from 28 percent in 1980. Farming jobs will fall from four percent to three percent. Service industries will make up 86 percent of the work force in 2000, up from 68 percent in 1980.

This is not to say there won't be unemployment, which will always be with us. If the current recession were to end tomorrow, 1.2 million unemployed workers in the automobile, steel, rubber, textile and railroad industries would still never get their jobs back. One sixth of those jobs have been eliminated by foreign competition from low-wage countries; another sixth have fallen by the wayside because of product dumping by nations subsidizing their industries; automation has done away with the rest.

There's a silver lining to these dark clouds. Productivity is on the rise, in part because of robotics, in part because of computer-aided manufacturing and computer-aided design that does things like place a new car's windshield wipers in precisely the right place without any time-consuming trial and error periods. Japan is already using robots to cut metal scrap loss on assembly lines from 15 percent to one percent, to save 40 percent of the paint that human spray painters once wasted and to reduce the failure rate on new cars to one fourth what they used to be. White collar workers in the Office of the Future will also see dramatic changes in their jobs. Machines that speak and listen will replace dictationists and as many as half of the secretaries and stenographers who now work in offices. Many of these displaced women will wind up manning robot control lines, banging away at word processing machines to keep the robots in line.

Our definition of full employment will also change. By the year

2000, an 8.5 percent unemployment rate may be acceptable, twice what an acceptable rate used to be. One reason is that as much as 3.5 percent of the work force will at all times be retraining themselves for new jobs. For example: assembly line workers being displaced by robots who are going through six months of schooling to become robot repairmen. Job patterns are definitely shifting. In 1980, 45 percent of American households had two people at work. By 1990, this will grow to 65 percent and by 2000 to 75 percent. This trend will allow easier exits from the workforce and easier re-entries beck into the workforce but it will also show up in statistics as a higher unemployment rate.

With these changes already taking place, Americans must learn the new jobs now and in the future. Vocational educators and trainers must gear up to provide this vital education and training to the workforce of the next two decades, jobs related to robots, lasers, computers, energy and battery technology, geriatric social work, hazardous waste management, and biomedical electronics. Table 1 lists some of the jobs that are disappearing and others that are growing in the shifting job market.

Twenty examples of specific occupations of the future, along with training requirements and expected salary ranges, are examined in the next part of this chapter. The final section of this chapter will develop several strategies that must be incorporated into our education and training system if we are to meet the demands of our technological revolution.

New Occupations for the 1990s

The following occupations are among those which we can expect to become increasingly important.[1] Included with each is a short description, starting salary, average salary, and training requirements. The descriptions have been prepared by Clyde Helms and Marvin Cetron, President and Vice President of Occupational Forecasting, respectively.

Energy Technician--650,000 jobs starting at $13,000, averaging $26,000.

Jobs will increase dramatically as new energy sources become marketable. Demand will greatly exceed available supply of labor in nuclear power plants; coal, shale, and tar sands extraction, processing, and distribution; solar systems manufacturing, installation, and maintenance; synfuels production; biomass facilities operations; and possibly geothermal and ocean thermal energy conversion operations.

Technicians, inspectors, and supervisory positions will require a high-school education and the equivalent of two years of technical college. Already, Toledo-Edison trains many of its nuclear plant personnel with a sophisticated computer-based education system. Why? So that as the pace at which job changes increase, training can be easily updated.

Housing Rehabilitation Technician--500,000 jobs starting at $14,000, averaging $24,000.

In the next 35 years the world population will double, intensifying housing demand. This will lead to mass production of modular housing, using radically new construction techniques and materials. Modular hosing will be fabricated with all heating, electric, waste disposal and recycling, and communications systems pre-installed.

Technicians, inspectors, and supervisors will require a high-school education and the equivalent of two years of technical education plus appropriate experience such as formal apprenticeship.

Hazardous Waste Management Technician--300,000 jobs starting at $15,000, averaging $28,000.

Despite recent EPA lapses, many years and billions of dollars may be required to clean up cities, industries, air, land, and water. Additionally, tens of thousands of jobs will be added in each area as breeder reactors and the mining and processing of coal, shale and tar sands reach commercial stages. When the requirements for collection, transportation, and disposal of radiological, biological, and chemical wastes are included, workers needed could well exceed 1.5 million.

Highly specialized technical training will be required for workers, supervisors, and managers in this very hazardous occupation.

Industrial Laser Process Technician--600,000 jobs starting at $15,000, averaging $25,000.

Laser manufacturing equipment and processes, including robotic factories, will replace much of today's machine and foundry tools and equipment. The new equipment, processes, and materials will increase production quality and quantity at lower costs.

High school, technical training, and retraining requirements will vary with levels of skill required under fast-paced job evolution.

Industrial Robot Production Technician--800,000 jobs starting at $15,000, averaging $24,000.

The microprocessor industry will become the third-largest industry in the U.S., facilitating extensive use of robots to perform computer-directed "physical" and "mental" functions. Hundreds of thousands of workers will be displaced. New workers will be needed to insure fail-proof operations of row after row of production robots.

Knowledge and skills requirements will compare with present-day computer programmers and electronics technicians. Thankfully, this production change can be planned and introduced in a step-by-step fashion, allowing workers to be retrained while maintaining jobs and some production levels. All that is required is good planning, something our industrial block has had problems with in the last couple of decades. As William C. Norris, founder of Control Data Corporation, a high-technology company, has warned: Unless the technology is managed, we could see a net loss of jobs.

Materials Utilization Technician--400,000 jobs starting at $15,000, averaging $24,000.

New materials are being engineered and created to replace metals, synthetics, and other production substances unsuited for advanced manufacturing technologies. Materials utilization technicians must be trained to work with amorphous and polymer materials and others produced through the process of molecular beam epitaxy, involving atomic crystal growth. In addition, there will be genetically engineered organic materials. These and other "manmade" materials will substitute for natural-element metals and materials now being depleted.

An education equivalent to that of an electronics technician, tool and die maker, nondestructive materials testing specialist, or industrial inspector will be required. Two years of technical college will be the minimum requirement.

Genetic Engineering Technician--250,000 jobs starting at $20,000, averaging $30,000.

Genetically engineered materials will improve upon and supersede current organic materials and also positively affect some inorganic materials processes. These engineered "manmade" materials will be used extensively in three general fields: industrial products, pharmaceuticals, and agricultural products. New and modified materials and substances will be produced under laboratory-like conditions and in industrial mass-production quantities. Technicians must be educated and trained to work under laboratory-type controls while producing in tonnage lots.

A bachelor's degree in chemistry, biology, or medicine will be helpful in the initial industrial production work, but production operations will be accomplished by "process technicians" with high-school and two-year postsecondary technical education and training.

Holographic Inspection Specialist--200,000 jobs starting at $20,000, averaging $28,000.

Completely automated factories that use optical fibers for sensing light, temperature, pressures, and dimensions will transmit this information to optical computers to compare this data with stored holographic, three-dimensional images. Substantial numbers of inspectors and quality-control staffs will be replaced.

Specialists working in this new technology will require a minimum of two years of postsecondary technical education and training, with emphases on optical fibers characteristics and transmission, photography, optical physics, and computer programming.

Bionic-Medical Technician--200,000 jobs starting at $21,000, averaging $32,000.

Mechanics will be needed to manufacture the actual bionic appendage (arm, leg, hand, foot) while other specialists work on the highly sophisticated extensions of neuro-sensing mental functions (seeing, hearing, feeling, speaking) and brain-wave control.

These technicians will require appropriate technical knowledge of microprocessors and specialized accredited education in the respective anatomical, physiological, and psychiatric disciplines equivalent to a minimum of four years of college work. Medical professionals who establish a reputation will move into the higher six-figure earnings levels.

Automotive Fuel Cell (Battery) Technician--250,000 jobs starting at $12,000, averaging $18,000.

These technicians will schedule and perform tests and services for new fuel cells and batteries used in vehicles and stationary operation, including residences. Such fuel cells may be charged and discarged by direct electric inputs from conventional electric distribution systems, by solar cells, and by exotic chemicals generating electricity within the cells.

These processes include potential hazards but can be safely serviced by technicians with a vocational high school education. While this sounds like an easy matter, public and private elementary and secondary schools currently are just accepting new technology into their processes at all. And while the acquaintance with and acceptance of new ideas usually has a snowballing effect, little has been done to date to establish vocational programs in high schools that can lead to jobs.

Some of this, of course, is a change in attitude. Only a few years ago, we convinced kids that they were "dummies" to study mechanics and voc-ed in high school rather than college prep.

Some educators like Floretta McKenzie in Washington, D.C., have seen the light and are diligently working to establish technical, vocational and science areas within their systems. McKenzie is leading the way by also using computer-based education.

On-Line Emergency Medical Technician--400,000 jobs starting at $16,000, averaging $29,000.

Needs for paramedics will increase directly with the growth of the population and its aging. In forthcoming megalopolises and high-density residences, emergency medical treatment will be administered on the spot with televised diagnoses and instruction from remote emergency medical centers. Despite reports of a forthcoming glut of doctors, they and other professional and paramedical specialists will become part of emergency medical teams, traveling in elaborately equipped mobile treatment centers.

To meet the needs for more complete treatment on site, education and training must be upgraded to an extent comparable to that required for registered nurses.

Geriatric Social Worker--700,000 jobs starting at $15,000, averaging $22,000.

These workers will be essential for the mental and social care of the nation's aging population. By the year 2000, the birthrate of native-born Americans will merely equal the "replacement rate"--zero population growth. Improvements in food, medicine, and life-extending medical processes will create the need for hundreds of thousands of workers to serve the aged.

Education and experience requirements comparable to those for licensed practical nurses, recreational specialists, mental hygienists, and dieticians will enable GSWs to find financially and physically rewarding employment.

Energy Auditor--180,000 jobs starting at $11,500, averaging $15,600.

Using the latest infrared devices and computer-based energy consumption and controlled networking, energy auditors will work with product engineers and marketing staffs in the production, sales, operation, and management of energy conservation and control systems for housing, industrial plants, and machinery. They will help architects and cost accountants achieve significant cost reductions through use of sophisticated heat sensing and measurement devices and systems, appropriate construction and insulation materials, and energy enhancement and recovery systems.

Technicians, inspectors and supervisors will require a high-school education and the equivalent of two years of technical college education plus appropriate apprenticing or on-the-job experience.

Nuclear Medicine Technologist--75,000 jobs starting at $18,000, averaging $29,000.

with the advanced understanding of medicines and serums using radioisotopes, a substantial increase in demand for this technologist will be needed. As the isotopes are absorbed in tissues and muscles, diagnosticians can observe functions of normal and/or damaged tissues and organs and can determine treatment needs and responses to medication in the central nervous, cardiovascular, pulmonary, digestive, and metabolic systems. Flow of medicines and effects can be traced and viewed directly on computer enhanced video displays, thus reducing the incidence of surgery.

Technologists must be trained to work in laboratory conditions, become familiar with sophisticated equipment, and be prepared to assist doctors and nurses in handling equipment and patients.

Dialysis Technologist--30,000 jobs starting at $16,000, averaging $25,000.

With the use of new portable dialysis machines and a greater number of hospital dialysis machines available, the demand for more dialysis technologists will grow.

These technologists must be educated and trained to work under laboratory conditions in a two year post-secondary technical education program including a four-week computer-assisted training program and instruction from other dialysis technologists.

Computer Axial Tomography (CAT) Technologist/Technician--45,000 jobs starting at $13,000, averaging $20,400.

Though more than a decade has passed since development of this technique for using x-rays with computer technology to give sectional views of internal body structures, the supply of qualified technicians has not kept pace with the growth of this non-invasive diagnostic science and equipment. Jobs for technicians to install, maintain, and operate CAT scanning systems and assist in the analysis of these scans will offer attractive employment situations for thousands of qualified people.

Minimum requirements for technicians include two years of postsecondary education and on-the-job training on the actual equipment in a participating hospital or equipment manufacturer. Minimum requirements for technologists include two years of instruction in anatomy, biology, and medicine. Fully qualified professionals will need further education leading to a baccalaureate degree.

Positron Emission Tomography (PET) Technician/Technologist--165,000 jobs starting at $14,500, averaging $17,500.

PET scanners are used for diagnoses of disorders of the human brain. Requirements for qualified workers in this field will increase with the growing use of this science, advances in human and computer technology, and research in human intelligence. Due to specialization in several technological and medical disciplines, technicians will be specialized.

Minimum requirements for technicians will include two years at the post secondary level. They will specialize in equipment, chemistry, physics, or computer programming. Technologists must be qualified at the professional level, including a baccalaureate degree. Both occupations will require on-the-job experience.

Computer Assisted Design (CAD) Technicians--300,000 jobs starting at 418,000, averaging $30,000.

New uses for applications for this new design, engineering, and production technology will create hundreds of new occupations for CAD specialists, both professional and non-professional. Millions of workers including blueprint file clerks, draftspeople, designers, engineers, researchers, inspectors, secretaries, and artists will find the computer can do more, better, and faster than traditional methods. Whether designing modes of transportation, dwellings, or other products, CAD will affect the education, employment, and ways of work more than any other single technology.

Education and training requirements will include high school diplomas and at least two years of postsecondary technical school.

Computer-Assisted Graphics Technician (CAG)--150,000 jobs starting at $20,000, averaging $35,000.

Rapid growth of computer-assisted graphics will affect the education, training and employment of all graphics technicians as no other event in graphics pictorial history. Demands for artists and technicians will increase ten-fold with an increase in demand for new forms and dimensions of graphics to portray objects, schemes, and scenarios before they are actually produced.

Basic education and training will still include the physics of color, layout, dimensions, etc., along with instruction on specialized effects attainable through computers, computer programming, and business potentials and effects.

Computer-Assisted Manufacturing (CAM) Specialist--300,000 jobs starting at $20,000, averaging $31,000.

CAM systems will permit all the design, development, specification, and logistics data to be pulled out of CAD and CAG data bases and be reprogrammed into computer-assisted manufacturing programs, which will then operate most of the production facility. This permits the attainment of Flexible Manufacturing Cells (FMC) in which every step of producing a product is determined and programmed sequentially for accomplishment without or with minimal human intervention. Education and training requirements must be changed in almost all occupations, especially in industrial and business management and personnel administration.

Education and training will include a high school education and at least two years of training in postsecondary or technical institutions.

Computerized Vocational Training (CVT) Technicians--300,000 jobs starting at $14,000, averaging $22,500.

Hundreds of thousands of these technicians will be employed in education and training materials development firms as this art becomes a new science to use in programs at all levels and in all disciplines in public and private educational institutions. Utilizing the demonstration capabilities and versatilities inherent in CAD software, in conjunction with the art and color expression of computer graphics, educators and trainers will be able to depict any object and any action with a vividness and dynamism that will produce higher learning benefits than any mode ever employed. Students will be able to assemble or disassemble the most complex mechanisms, construct the most artistic forms, design dwellings and structures without ever leaving their computer terminals. While "hands-on training" will remain an essential part of vocational training, terminology and work sequencing will be learned at the CRT. Textbooks and lesson plans, lengthy lectures and dissertations will become passe in the coming decades of learning by doing at the computer terminal interface. Up to 75% of all instruction will be acquired at the computer console, allowing teachers to spend much more time helping students learn actual on-the-job work skills with actual products and processes.

Technicians working in this new area will specialize in graphic arts, computer programming, educational and learning theory and practice, and technical competence in respective vocational technologies. At least two years of technical education after high school will be required.

Strategies to Provide Training for New Jobs

To ensure the vocational education field provides the education and training needed by the labor force of the future three areas of concern must be addressed: training competent teachers; changing prevailing attitudes toward education, training, and new technologies; and updating teaching methodology and instructional materials.

Training and Attracting Competent Teachers

Currently, competent teachers are not attracted to the profession due to low salaries and low status. Competent teachers in vocational education, math, and science can earn 50-60% more in the private sector. The decline in this profession must be stopped and can. Over the years, teacher edcation programs have encountered declining enrollments, due, in part, to low salaries, to oversupplies during baby boom years, and to the high status of working in the private sector. To counteract the declining enrollments, teacher training programs lowered their standards for entry which resulted in attracting a lower caliber of student and also becoming a curriculum of last resort for students failing in other areas.

To reverse this trend, long- and short-term strategies must be instituted nationwide. Teaching can be made more attractive through the support of administrators and by raising the salaries of teachers, especially in those areas of high demand, i.e., vocational education, math, and science. Raising the salaries by 20% across the board and by an additional 20% in those areas of high demand, will attract teachers back from the private sector and encourage a higher caliber of student to enter undergraduate teacher preparation programs. The law of supply and demand will work if other constraints, such as inflexible pay scales and tenure laws, are lifted; but standards must not be lowered.

For long-term solutions to assuring a supply of competent teachers, a series of three hurdles must be instituted by teacher preparation programs and departments of education on a national basis:

1. Before acceptance into a teacher education program, students must have scored at least 850 combined total on their SATs and have passed a proficiency test in reading, writing, and computational skills.
2. Before continuing in a teacher education program, students must maintain above average grades (3.0 GPA or the equivalent) for the first two years of undergraduate work (or the equivalent).
3. Before receiving permanent certification, a teacher must pass a competency examination and positive evaluations from

supervisors, administrators, and/or peers.

These are not new suggestions; each has been implemented successfully in several states already. The implementation of these standards will not happen without controversy. Witness the furor caused by Penn State's Joe Paterno and the NCAA when they decided to require a total of 700 on the SATs before accepting college atheletes. But for the sake of the teaching profession as a whole, each of the three (entry standards, maintenance standards, and certification standards) must be initiated and maintained on a national basis.

The insistence on higher salaries and other benefits to attract good teaching professionals will raise flags with cost-conscious and/or bankrupt states and school districts.

That is why the promotion of cooperation between the public and private sectors is so valuable in the academic arena. High technology companies have the equipment, R&D, systems and personnel to assist schools and teachers during this transition time.

Requiring each prospective teacher to overcome these hurdles will tighten the profession's standards and limit the numbers entering to the best. The resulting shortage of teachers will raise salaries and attract more from other places. The downward spiral will be reversed and the status of the teacher will rise, along with the salaries, and the level of competence. If we do not reverse the trend, we may be forced to use teachers from foreign countries, similar to the medical profession's solution to maintain medical services in rural America.

To relieve the short term lack of math, science, and vocational teachers, rather than tolerate less than the best, we could arrange to have good teachers or business people in these fields who have retired, take a 1-2 month refresher course and return to the classroom for a year or two. To further alleviate the shortage, we could encourage corporations to make available some of their skilled technical people to provide some teaching.

Along with limiting entrants into the profession to the best our nation has to offer, we must continually update the good teachers we already have. For example, computer literacy for every high school student and every teacher mut be required. Inservice programs provided by school districts or departments of education should be available and every teacher should be able to pass a computer literacy test within 4 years. Some colleges and universities have firmly implanted the seed of computer literacy with some good results already. Hamline University in St. Paul, Minnesota, has a computer literacy requirement of its students that is comparable to other required courses such as English and beginning mathematics. No student may successfully leave Hamline's hallowed halls without computer proficiency. Now several other private schools in the Minneapolis-St. Paul area are joining the literacy network, among them the College of St. Catherine's, a private women's college.

And they use the technology, PLATO computer-based education, to learn the technology.

If teachers do not fill the gap in their skills, they should be phased out on the basis of failing to keep current with the requirements of the profession. To win the salaries and esteem that the profession deserves, we cannot keep deadwood within our ranks.

Changing Prevailing Attitudes Toward Education, Training, and New Technologies

Across the board, the gap is closing between the highest and lowest students. Special programs help the lower students come up to their capacities, however, few programs help the truly brilliant students perform at theirs. Teachers who could teach brilliant students are going into other occupations and are being replaced by less adequate teachers. We only need a few exceptional students and creative individuals to meet our needs; it is not the quantity, but the quality that counts. However, those with the potential are not getting the necessary support.

The U.S. Departent of Education has recently issued a report in which it recommends (1) increased support for math and science, and (2) revision of high school math and science requirements.[2] These revisions are vital if we are to maintain the lead in technology that we now enjoy, especially since other countries are rushing to close the gap. For example, Russia requires 7 years to our 2 1/2 years of these subjects in high school.

We must encourage our youth, especially girls, to be proud of their skills in science, math, and vocational subjects. Students in any of these areas of study should not be made to feel inferior to anyone. Traditional funding sources, as well as parent/teacher groups, boosters clubs, etc. should be encouraged to make money and give funds to "mathletes" and "chemletes" as well as athletes. Students should be given letters in math, physics, chemistry, and vocationally-related extracurricular activities, similar to athletic letters. If students earn letters in two or three activities, they should become two or three letterpersons. Finally we should be pouring dollars into computers rather than stadiums.

People must be equipped to change. As important as math, science, and vocational skills are, they are not enough. As society changes, so will the skills and knowledge needed to be productive and satisfied. The higher levels of cognitive skills must be learned as early as possible. People must be taught skills in decision-making, problem solving, creativity, communications, critical thinking, evaluation, analysis, synthesis, and the structuring of problems to understand what the results ought to be. Make people think. And make people communicate. Already, our well-educated chief executives, who should and do know better, depend on industry lingo to communicate their ideas. The day of the simple sentence, using real not "synthetic" words must dawn again, or the lapse among buyer and seller, maker and user will never be filled.

Updating Teaching Methodology and Instructional Materials

Keeping vocational education programs up-to-date always has been a problem. The rapid pace of technological change accentuates and widens the gap between programs and the cutting edge of knowledge. Budget cutbacks make the problem even greater. The same problem has hit industry. Consequently, businesses are turning to computerized training to lessen the cost and, at the same time, maintain or improve the quality of their programs. At the forefront of this nationwide trend is the PLATO Computer-Assisted Instruction (CAI) system developed by Control Data Corporation, Minneapolis.

The applications for PLATO are as limitless as the range of business and industry itself and such diverse industries as manufacturing, petroleum, banking, real estate, finance, aviation, and emergency medicine find PLATO indispensable. Individual companies and associations training with PLATO include, but are not limited to, American Airlines, General Motors, General Mills, Shell, DuPont, Federal Express, National Association of Securities Dealers, Bank Administration Institute, Con Edison, and Merck Sharp and Dohme.

Commputer Assisted Instruction (CAI) is easily adaptable for short term training. Many of the unemployed need two or three months of training for a job that will exist. CAI is practical and effective. Currently over 12,000 hours of training make up the body of PLATO, with more added constantly. The information is up-to-date. If this or similar programs were implemented in vocational-technical schools, every teacher and every student would have immediate access to the most recent information available. Students could learn theory and related content on the computer. Teachers could then work individually with students for the hands-on training which is so vital in vocational education. This requires a different type of thinking by the teachers. Insecure teachers will feel threatened by the computer if they have not yet become computer literate. The computer is a tool to make teaching more efficient and more effective--not a replacement for the teacher.

This fear is dissipating somewhat as micros march into the classroom. The businesses who sell the technology are somewhat to blame. Control Data, for example, has spent much time helping educators incorporate the technology into the classroom so that everyone -- students, teachers, taxpapers -- receive the maximum benefits from technology.

And as teachers realize the power they can exert through the computer -- introducing and updating courses, record-keeping, administrative functions -- the teacher replacement issue will fade.

Maintaining a skilled workforce will take an enormous expenditure of resources. Operating training programs in vocational, technical, and industrial facilities 24 hours a day will eliminate much of the need for duplicating expensive equipment.

Even more importantly, we must use our training dollars only for jobs that exist or will exist in the near future. In the past the training programs sponsored by CETA did not give Americans what was promised. Sixty percent of the money was used for administration; the remaining 40% went into training. Out of this, only 3% of the trainees actually obtained jobs. The people were trained for jobs that did not exist and will not exist. For example, up until 1979 people were still being trained to be linotype and elevator operators, even though a need for these skills had not been identified for the preceding 10 years. In fact, the equipment had not been manufactured for 15 years preceding 1979.

The new Job Partnership Training Act has tried to correct this by requiring that 70% of the funds go to actual training programs, and limiting administration to 15%. The remaining 15% is designated for basic literacy education and for childcare services for trainees.

Conclusion

The jobs of the future are changing in nature. We need to make short and long term changes to avoid disastrous consequences. First, we should begin to encourage the unemployed to upgrade their skills and take lower paying jobs as temporary solutions. Next, we need to get our education system back on track to produce educated minds that accept the challenges of the future and want to learn more. Strong emphasis on education is necessary; however, it is not sufficient. We also need training for the occupations of tomorrow. Finally, we must admit where we have gone wrong and do what it takes to make America one of the strongest and most stabilized countries of the future.

References

1. Cetron, Marvin, and O'Toole, Thomas. **Encounters With the Future: A Forecast of Life in the 21st Century.** McGraw Hill: 1982.

2. **National Assessment of Education for the Last 13 Years.** Educational Commission of the States: Denver, CO. January, 1983.

Table 1 The Shifting Job Market

Some jobs that will be disappearing by 1990:

Occupation	% Decline in Employment
Linotype operator	-40.0
Elevator operator	30.0
Shoemaking machine operators	19.2
Farm laborers	19.0
Railroad car repairers	17.9
Farm managers	17.1
Graduate assistants	16.7
Housekeepers, private household	14.9
Childcare workers, private household	14.8
Maids and servants, private household	14.7
Farm supervisors	14.3
Farm owners and tenants	13.7
Timber cutting and logging workers	13.6
Secondary school teachers	13.1

Some jobs that will be growing until 1990:

Occupation	% Growth in Employment
Data processing machine mechanics	+157.1
Paralegal personnel	143.0
Computer systems analysts	112.4
Mid-wives	110.0
Computer operators	91.7
Office machine service technicians	86.7
Tax preparers	77.9
Computer programmers	77.2
Aero-astronautic engineers	74.8
Employment interviewers	72.0
Fast food restaurant workers	69.4
Childcare attendants	66.5
Veterinarians	66.1
Chefs	55.0

Mr. GORE. Thank you very much.

We are going to hear from the rest of the panel before we ask questions of you, but I know there will be a lot because your testimony is very thoughtprovoking.

I might just mention in passing to our next witness that the people who run the program in Pittsburgh, that the President is visiting today will be testifying here tomorrow during the second day of these hearings.

Our second witness on this panel is Paul Strassmann, vice president of the Information Products Group at Xerox Corp., who has studied the impact of ne technologies on the economy.

Mr. Strassmann, we are delighted to have you here. Please proceed.

STATEMENT OF PAUL STRASSMANN, VICE PRESIDENT, INFORMATION PRODUCTS GROUP, XEROX CORP., STAMFORD, CONN.

Mr. STRASSMANN. Thank you, Mr. Chairman.

I have spent my entire career installing information technology in the office, white-collar environment, and I would like to confine my remarks entirely to the white-collar relationship to information technology.

Also, to keep within the 10-minute limit, I would like to have your permission to use slides as a way of speeding up communication.

Mr. GORE. That will be fine.

Mr. STRASSMANN. The committee was asking for predictions, and I want to issue a disclaimer. We cannot predict; we can only say what can we do in order to create a society where there will be a potential labor shortage. I will highlight productivity in the same way as Mr. Skeen highlighted productivity as the key to employment. I will dwell on that point.

I will then try to present to this committee that the present way of looking at jobs in terms of service sector jobs versus goods producing sector jobs is not perhaps the most useful way of looking at the future. Next I will describe the new jobs.

Let me begin by the theme of productivity. We, in the United States are a society that has climbed the level of output in terms of national income per capita to about a $10,000 income. The society is experiencing its maturity through declining jobs and through increasing automation. We are not able to provide new jobs.

What I will project to this committee is a new horizon, which could bring us perhaps to a level of at least $50,000 of real income per capita. New factors of production, based on information, can create a completely new economic environment.

The point I want to make is that the current debate about productivity, as being synonymous with unemployment, is faulty. I totally reject the idea that a productive society must have an environment where there is unemployment. We know that full employment is possible both in a productive as well as in an unproductive society.

I would like to suggest to this committee that the key issue about jobs of the future is aggregate output in terms of high productivity performance of the work force.

I will admit that in the event we are just slicing the same pie, then automation will cause unemployment. The ease that I will present this morning is a case that if we want to create full employment, we have to radically reposition our labor resources so that we can more than double real income per capita.

In America and in our Western society we have seen again and again the ability of society to double and triple output in income, and that is really the key to the future.

Now in order to understand how we can double output, how we can realize enormous opportunities for our work force, I would like to suggest to you that the current way of looking at jobs may not be entirely correct. The current approach basically is to look at goods producing jobs, the blue line, on my exhibit. It shows about 30 million jobs projected to be fairly level or, if Mr. Cetron is right, actually declining. Adding to these 30 million jobs are about 70 million service jobs. That is how you get the 100 million jobs.

However, I would like to draw to your attention a different line, approximately 50 million jobs which I have identified as "information-producing" jobs. Let me suggest to you that the way I am going to present my argument today is to say that there are 50 million information workers in the U.S. economy, and there are 50 million goods producing workers. I will concentrate on the pivotal role of the 50 million information workers in determining the productivity of the United States of America over the next few decades.

Now just to make sure that we understand what we mean by information workers, here are the occupational categories showing people and the percentages. When you look where we are spending our manpower today and how we allocate efforts, about 80 percent of our white-collar work force is really operating ongoing administrative processes and only about 20 percent is devoted to investment in the future, which includes education.

I hope you bear with me with this rather complex diagram, but I want to point to this disaggregation of the U.S. economy between the production sector and the information sector. You see what goes to the consumers, which is 1.87 trillion. You find that, in fact, the information-handling sector gives only a very small fraction of its output to consumers. Most of the information sector, the overwhelming amount of it, is going really as overhead on top of the job of producing goods.

Let me repeat. The vast amount of white-collar labor in America is deployed as overhead. One of the reasons why there is a decline in productivity and why our income per capita is not growing is that we are an overhead-rich society. An overhead-rich society is not competitive. An overhead-rich society tends to create a displacement of labor. An overhead-rich society does not grow income. Therefore, it does not create jobs.

The key to the future of America is how we can take the highly skilled resources we have in information handling—our managers, professional technicians, our teachers, our artists—and really have them contribute to increasing the wealth of the society.

Where are those people? I want to point out that, by and large, $525 billion of their cost is in social-related services—Government, education, health, and so forth, and, of course, corporate bureaucracies.

It is the concentration of these jobs in two areas—manufacturing overhead and socially related overhead—that then creates the drag on our ability to produce. The reason why this is a drag, if I may use that term, is because the bulk of our overhead costs are not subject to any market forces. We have created a society where we have taken the possessors of information and, by and large, we have segregated them into jobs where the accountability for their performance is not directly regulated by market forces.

What do I then see are some of the major trends that will shape the direction of jobs of the future? I will present to you three major trends which are, in my opinion, necessary to get our society going toward substantially higher levels of income.

First, jobs which today are in what I call information overhead categories have to become services subject to market. This means that rather than to own big corporate staffs or big consulting staffs in organizations, in Government, in universities, you should be able to purchase those services as management services from the market. The same applies to office services.

Information technology is the key enabler to this shift. Information services now provide the avenue for creating a marketplace for information labor on a transaction basis.

I believe that the solution to the problem of training, vocational education, is to take the funding for education, to as large extent as possible, out of social overhead and place it as a direct cost for achieving a given objective.

Information technology is uniquely attuned to achieving that objective.

Preventive medicine is clearly the kind of service that is subject to market. I see the movement on the part of insurance companies to start providing incentives so that you can get services which improve your well being rather than cure your disease. Of course, consumer information is necessary so that consumers can make intelligent market-oriented decisions.

The second major trend that will unlock our potential of productivity is that we will have to reallocate a much larger portion of our white collar resources from administration and custodial expenses to creation and investment in the future. Tax laws and incentives have to be created so that software development, education based on delivered performance, entertainment and art, health and public services, and research development consume a much larger proportion of our white-collar resources than is currently the case. Twenty percent of our white-collar resources devoted to investment is not enough.

Last, I see that productivity will come through conveying to our population a different image of what jobs are all about. The current vision of jobs is that you get trained. You go to school, you get a certificate, and then you become a specialist. Such a pattern does not lead to productive jobs.

The jobs which we have studied over a decade, which are productive, are jobs where people can do a variety of tasks; namely, the forklift operator in the warehouse also makes decisions about pick lists, shipping, and loading the truck, rather than having to go through a clerk. The forklift truck operator is both an operator and an information worker.

This means that every day is training day. It is not the idea of going 3 months off to a retreat to study and then coming back retreaded. That is not the image of the future. Every day is training day.

All production is customized. That is why we need generalists. Of course, we must then provide a much more flexible working environment.

In conclusion, then, Mr. Chairman, I am suggesting that if America is to become a productive society, we are going to have a job scarcity. We will not have enough people, and that is the scenario I think that we ought to establish as our agenda.

The key to our achieving a highly productive society is to take the information workers and make them productive. That means that we will have to shift to a market-oriented economy. Of course, new skills will be necessary and many new policies will be necessary. Within the confines of the charter today you wanted to have an outlook, a scenario of the future.

Thank you very much.

[The prepared statement of Paul A. Strassman follows:]

U. S. HOUSE OF REPRESENTATIVES

Committee on Science and Technology - Subcomittee on Investigation and Oversight

IMPACT OF INFORMATION TECHNOLOGY ON EMPLOYMENT

Testimony by:

Paul A. Strassmann, Vice President

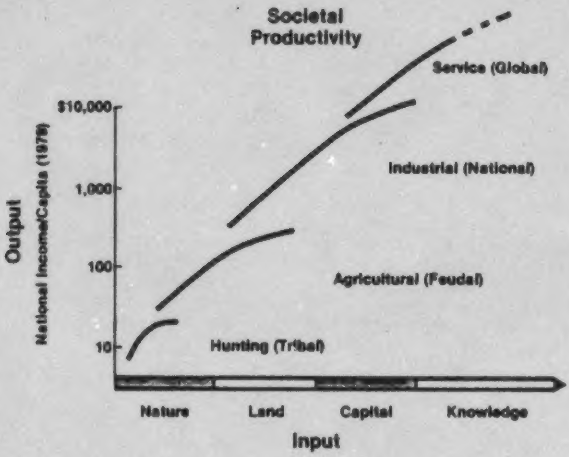
Information Products Group

April 6, 1983 **XEROX Corporation, Stamford, Ct.**

Mr. Chairman and distinguished members of the Committee. My name is Paul Strassmann and I am Vice President of Systems Applications in the Information Products Group of the Xerox Corporation. I have spent my entire career in managing the installation of information technology.

Your invitation stated that you are interested in hearing about new and changing jobs as well as in our ability to predict them.

I cannot predict the future. However, I will present to you a scenario of conditions that could lead to a material reduction in unemployment levels. I will identify improved societal productivity as the key to creating such a desirable condition. I will also address how improved productivity relates to our current concerns about generating unemployment through job displacement. Next I will highlight the critical role of information jobs in the future and what changes may be necessary. Lastly, I will describe the new jobs, how they will differ from work today, and what can be expected to be the growth areas in information worker occupations.



The scenario that may produce a severe labor shortage is based on the transformation of the US from an industrial society into a highly productive service society, with national income per capita in the $15,000 to $25,000 range within twenty to fifty years. The current income in 1979 terms, is less than $10,000 per capita and has remained stagnant as we keep adding less productive service labor, without adequate capital, to an industrial base which does not employ capital efficiently.

Diminishing societal productivity is not something altogether new. A hunting society, based entirely on the exploitation of nature, reaches diminishing productivity at a very low level of about $25 per capita. An agricultural society, based entirely on the exploitation of nature and land, reaches diminishing productivity at about $250 per capita. It seems that industrial societies reach their diminishing productivity at about $10,000 capita. If we can create a highly productive services economy, I see no limit on the wealth we can generate and on the amount of labor resources we can employ productively.

Technological Unemployment

○ Full Employment Possible both in Productive or Unproductive Societies

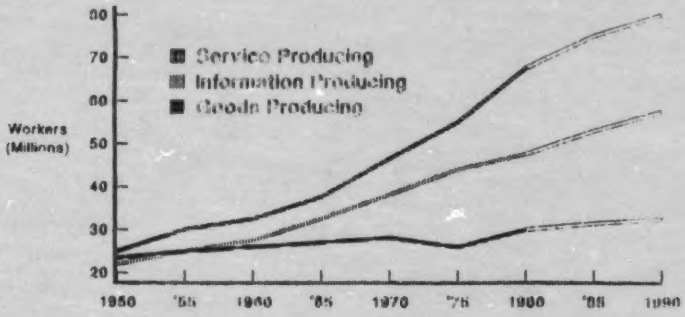
○ What Matters is Aggregate Output

○ If Output does not Change Automation Causes Unemployment

○ For Growth in Output/Capita Automation is Neccesary

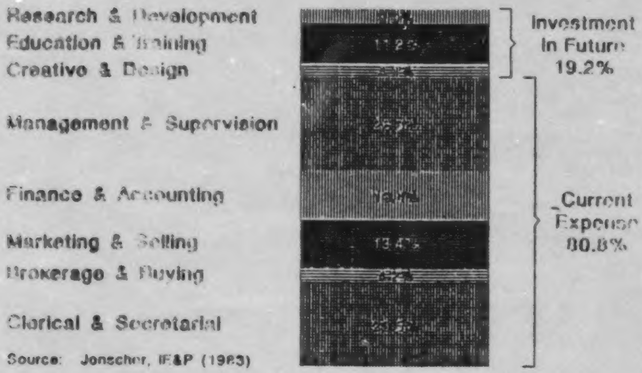
It is unfortunate that "productivity", which I have used as the necessity for future gains, has become identified with unemployment. I totally oppose tying in discussions about productivity gains as always resulting in increases in unemployment. Full employment is possible both in productive and in unproductive societies. What matters is aggregate output. Increases in aggregate output generate wealth and create new jobs. If you have a society where output does not grow then you will have unemployment if automation is introduced. In a productive society the objective is to increase the total wealth of citizens. If we can double wealth, as we have done many times in the past, then we will not have technological unemployment.

Growth Of Employment By Industry Sector



I will now highlight a different breakdown of employment trends as a way of dealing with the issues of changes that are needed in the workplace. The conventional employment growth curves show fairly stagnant employment in goods producing sectors and strong growth in the services producing sector. The two curves add up to total industrial employment of less than 100 millions workers in 1980. I want to draw your attention to the third line, designated as information producing workers. In 1980 there were about 47 millions in this category. Most of them can be found in the services sector, even though a large portion of goods producing employees are also in information producing jobs. I consider the information workers the key to achieving productivity gains in the future.

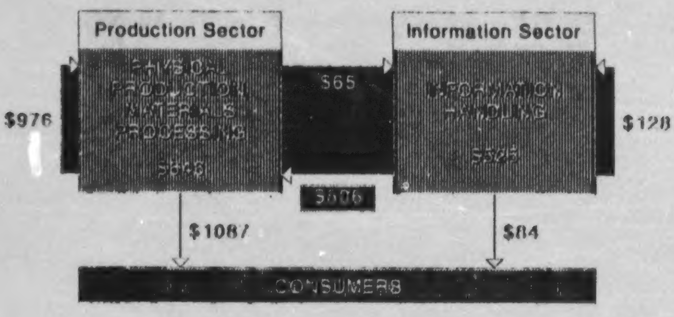
U.S. Information Workforce (1978)



Source: Jonscher, IE&P (1983)

Since the information workforce is so important in what will follow I want to show a further breakdown of the categories included in this classification. It tabulates jobs we have come to recognize as "white collar" occupations. These are people who are dealing with information as their principal concern at work. It also groups people into a class that can be considered as an investment in future improvements in productivity and a class that administers ongoing operations.

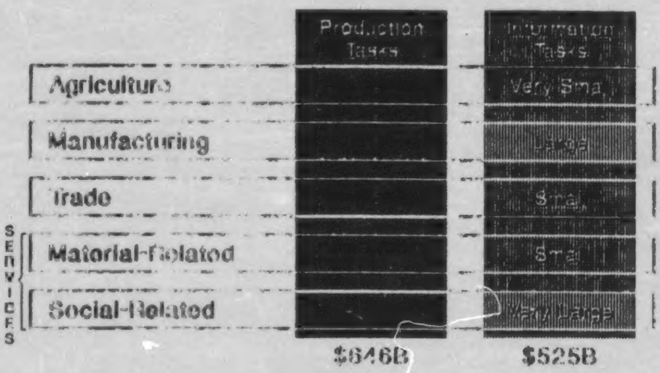
National Economy - U.S.A. [1972, Billions]


Production Sector
PHYSICAL PRODUCTION MATERIALS PROCESSING
Information Sector
INFORMATION HANDLING
$525
$65
$606
$976
$128
$1087
$84
CONSUMERS

Source: Jonscher, IE&P (1983)

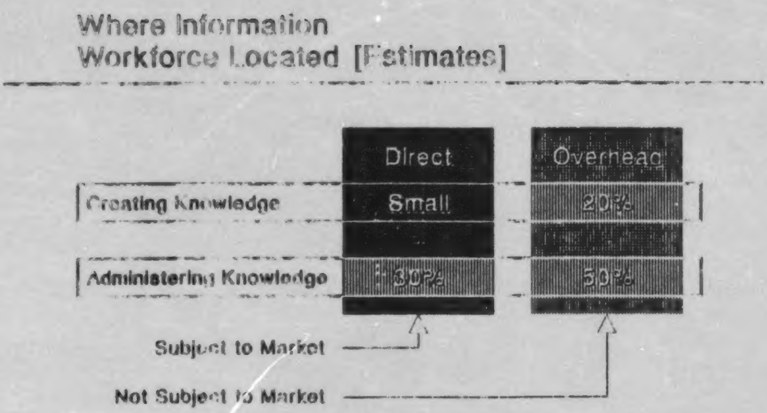
It is very useful to examine the contributions of the information sector. We do not have current numbers. The best work in this field are the analyses produced by professor Charles Jonscher of MIT, the most distinguished economist in the emerging field of information economics. The trends I will note have become magnified since 1972. What is noteworthy is the flow of costs between the Production and the Information Sectors. For every dollar of output to consumers the Production Sector has to use almost a dollar's worth of information labor. At present, the costs of information labor exceed the costs of physical production of goods and services.

Where Information Costs Located [Estimates]



		Production Tasks	Information Tasks
	Agriculture		Very Small
	Manufacturing		Large
	Trade		Small
SERVICES	Material-Related		Small
	Social-Related		Very Large
		$646B	$525B

Information costs are highly concentrated in the economy. We find them primarily associated with socially related services, such as in health, in education, in legal services. They are also found in manufacturing, in the form of administrative and managerial jobs.



Where Information Workforce Located [Estimates]

	Direct	Overhead
Creating Knowledge	Small	20%
Administering Knowledge	30%	50%

Another way of looking at the deployment of the information workforce, is to examine what portion of the total is employed in positions that are directly subject to the forces of the market economy and what part is occupying positions which are designated as organizational "overhead". In my estimate, over two thirds of all information worker costs are to be found in positions that are many layers away from the direct forces of the marketplace.

NEW JOBS:

Now: **INFORMATION OVERHEAD**

Future: **SERVICES SUBJECT TO MARKET**

Growth Areas:
- **Management Services**
- **Office Services**
- **Network Information Support**
- **Training, Vocational Education**
- **Preventive Medicine**
- **Consumer Information**

I will now proceed to tell the Committee about the new jobs. Rather than give you numbers and occupational titles, my remarks will be set in the context of changes that will be necessary in order to improve societal productivity and in order to increase aggregate wealth available to our citizens.

We must make it possible to take information workers from jobs which are now carried as an overhead burden and place them in jobs which are structured so that they render services that are subject to the test of the marketplace. For example, I see major cost improvements in our goods producing sector to come from eliminating fixed overhead costs and acquiring much more efficient services at competitive rates. This will cause growth in many new areas and should also lead to increasing our advantage in exporting profitable services on a global scale.

NEW JOBS:

Now: ADMINISTRATION, CURRENT EXPENSE

Future: CREATION, INVESTMENT IN FUTURE

Growth Areas:
- Software Development
- Performance Education
- Entertainment, Arts
- Health, Public Services
- Research, Development

One of the principal reasons for the low levels of productivity of the information sector is its high labor intensity and low utilization of capital. Even though shipments of information technology products from the goods producing sector into the information sector are expanding faster than any other cross-industry variable, the limit on realizing future growth in productivity is not to be found in technology but in the way information workers are employed. I believe that we will have to redeploy large numbers of information workers from jobs where they are a current operating expense, into jobs in which they contribute to improved productivity by becoming a profitable investment. The growth areas will then be in jobs which involve the creation of new skills and new opportunities.

NEW JOBS:

Now: OCCUPATIONAL SPECIALISTS

Future: SERVICES GENERALISTS

Growth Areas: Operators also do Information

Interactive Training

Customized Production

Distributed Management

Computer-aided Work

Part-time Work, at Home

Lastly, I see the emergence of new concepts organizing people in the workplace towards achievement of greater productivity. The last hundred years of the industrial civilization have been based on the concept of job specialization and task subdivision. The large expansion in the information workforce has been largely due to the employment of narrow specialists to handle matters of ever increasing complexity.

The future lies in jobs where individuals will have the opportunity to become generalists, that is, to do several tasks needed to get a job completed. "Blue collar" operators will also perform "white collar" tasks. Job enlargement will be possible because training will be continuous, on the job. Production and services will tend towards customized production rather than mass output by specialists. Employees will have to start assuming tasks which were previously reserved to management. The enabling technology to managing this increased complexity will be the personal computer, directly available to every person. The habits of the information worker will also change. Part-time work and work from the home will change attitudes about employee relations.

SUMMARY:

- * MANPOWER SCARCITY IN HIGHLY PRODUCTIVE SOCIETY.
- * KEY IS PRODUCTIVITY OF INFORMATION WORKERS.
- * AN EFFICIENT SERVICE ECONOMY HAS MARKET-BASED WORKFORCE.
- * NEW JOBS WILL REQUIRE NEW SKILLS.
- * NUMEROUS POLICY CHANGES NECESSARY BY GOVERNMENT AND BUSINESS.

I will now sum up. The scenario I presented today presumes that we will realize the enormous potential that is now available. To get there, we will need a workforce which not only has different jobs but also different working and behavioral patterns. For the purpose of these hearings I concentrated entirely on the changes necessary for more than one half of the workforce - the information workers. These changes will make it necessary to increase the influence of market forces on the allocation of resources. New occupational and managerial skills will have to be applied. I hope that the Congress will recognize that numerous policy changes will have to be introduced both by the government and by business before we will be able to aspire to doubling real income and to a labor shortage in a productive service economy.

Thank you.

Mr. **Gore**. Thank you very much.

We will also hold our questions for you until our panel has been completed.

Neither of the other two witnesses have slides, do you? We will turn the lights back on.

Harley Shaiken, our next witness, is a researcher in the program in science and technology in society at MIT at MIT's Laboratory for Manufacturing and Productivity.

We are delighted to have you here, Mr. Shaiken. Please proceed.

STATEMENT OF HARLEY SHAIKEN, RESEARCH ASSOCIATE, MASSACHUSETTS INSTITUTE OF TECHNOLOGY

Mr. **Shaiken**. Mr. Chairman, I am delighted to be here.

I think the whole issue of technological change could be the most critical one we face in the coming decade as a society. I would like to get what I think are some strawmen out of the way at the beginning.

I do not really think the issue is the desirability of new technology or increased productivity. Both clearly present enormous positive social benefits to the society. The real issue, I think, is the social cost of the change and how that social cost is going to be paid. In this regard, I think we have given inadequate attention to the way these technologies are being implemented, how people are directly being affected, and the kind of transition that is going to be made.

What I would like to highlight today is why I feel these new forms of technology, automation based on microelectronics and computers, are fundamentally different than the kind of automation we have seen in the past.

In addition, I think the economic situation today in which these technologies are being introduced is also clearly different.

I would like to start, however, with a disclaimer. In any complex technological society employment depends on more than technology alone. It depends on other critical factors such as economic growth, demographics, and a range of other things. That notwithstanding, today we are looking at the introduction of a technology of unprecedented labor displacing potential. In that regard, I think we have to take very seriously the possibility that unemployment could be a short term, and possibly a long term, result of the kind of changes that we are seeing today.

However, I do not think we have to look toward the future. With 11 million people already unemployed, the key issue is not the possibility of displacement but how many people who are currently out of work, not as a result of technology but as a result of a market failure, as a result of poor competitiveness, how many people who are currently out of work never will return to meaningful employment. That makes the issue I think far more compelling and urgent than merely trying to predict displacement, let's say, in 1990 or the year 2000.

In a sense there is a false sense of security today because with an economic downturn comes a delay or a deferment in the introduction of new technologies in a wide range of industries. However, as the economy begins to recover, what we are liable to see is a pent-up demand in terms of capital acquisition that literally becomes unleashed. In a sense robots could be returned to the job in all kinds of key industries far before unemployed workers are called back.

This raises two dangers. The first is structural unemployment, not enough jobs for the number of people who want to work in the society. I will get into this in a moment.

However, the other danger we are seeing already is regional dislocation. Even if there is a shortage of computer programers on Route 128 in Massachusetts, it does unemployed autoworkers in Detroit very little good. In fact, sometimes we can have dislocation without the geographical component.

The resurgence of high tech in Massachusetts is often considered a model for where workers in declining industries, such as textiles, could find new employment. In fact, the textile industry declined in Massachusetts; high tech soared. Yet, recent studies by my colleagues at MIT and Boston College have pointed out the fact that only 3 percent of those people that were employed in textiles ever found jobs in high tech in Massachusetts.

The real danger today that we are seeing is manufacturing Appalachias in the 1980's—even if the economy performs well in the aggregate, pockets that do not share in the new prosperity.

However, isn't there a sense that we have heard all of this before? Weren't these very same issues raised in the late fifties, the early sixties, the Presidential Commission on Automation of the sixties? Why is the situation today any different than what we have discussed in the past about automation?

I think one central difference is the character of the technology itself. Automation in the past largely meant mechanical movement in certain basic manufacturing industries. Automation today I think is fundamentally different in four important respects: Its scope, the fact that it affects product in process, the fact that it is a technology of systems, and, finally, the indirect effect that makes possible global production. I would like to elaborate on each of these for a moment and their relation to employment.

In the past automation was limited to one sector of mass production, but today we are seeing the deployment of new technologies based on computers and microelectronics into every productive sector of the society and into every sector simultaneously. The danger is employment vice, where people are displaced from the factory but new jobs do not open up fast enough in the office and the service sector. Displacement is nothing new with mechanization. There was displacement since the industrial revolution. What is potentially new today is the lack of alternatives for those people who are displaced.

Another key factor about the scope of this technology is it just does not affect one job at a time. It is a very dynamic process. Many jobs that are created today as a result of automation tomorrow themselves could be automated.

In the 1960's when numerically controlled or computerized machine tools were introduced, the promise was held in terms of employment for machinists of part programing. Yet, today the same automated techniques that were applied to machining of the sixties are being applied to part programing of the eighties. The danger is that those jobs created as a result of automation—our promise for today becomes our problem tomorrow.

In terms of product in process, these technologies not only affect how we produce something, they dramatically increase the sophistication of the product while reducing the time it takes to manufacture and assemble the product. In the late 1970's the National Cash Register Corp. predicted that the electronic cash register required 25 percent of the labor to produce an electromechanical version that it replaced. This obviously has a very clear and direct impact on unemployment prospects.

Also, today we are looking at a technology of systems. There are extraordinary productivity gains possible, not by heavy capital investment, but by using computer technology to tie together existing systems and to rationalize production. Therefore, in the eighties what we may see is, for a very limited investment, large productivity gains, again raising the question of what are the alternatives available.

In fact, over a 10-year period, if employment grows at 5 percent, then 39 percent fewer workers, all other things held equal, are needed to produce a given product. Of course, all other things are never held equal, but this gives some kind of a scale of the employment possibilities that could occur here. If 39 percent fewer workers are needed for 5-percent productivity growth, what do we do in those industries where 6-, 7-, and 8-percent productivity growth is being predicted?

Finally, there is a hidden dimension to job loss in technology, which is the ability of these technologies to create an infrastructure that allows global production. If jobs are going to be created as a result of the technology, the production must take place within this economy. Yet, we are seeing through telecommunications and computers, the ability to take the most complex of manufactured products and decentralize production, controlling operations worldwide, and shortening supply lines electronically.

For an engineer in the automotive industry, sitting in front of a video display terminal in Germany, or sitting in front of a video display terminal in Detroit or Sao Paulo, Brazil, geographically they are thousands of miles apart; but in terms of manufacturing coordination and design ability they are sitting in the same room. It creates an infrastructure that, given other economic pressures, could lead to very large-scale decentralization of production.

The University of Michigan in a recent study predicted that the automobile industry by the early 1990's could be producing 35 percent of the parts it uses in U.S. assembled vehicles outside the United States, a very significant potential drain in terms of employment.

Also, there could be a strong mismatch between the skills created in new emergent industries and those skills that are being eliminated in those industries where automation is being introduced. One conception that the manufacture of these new technologies itself will, in fact, create significant employment opportunities is flat wrong. These are supposed to be labor-displacing technologies. Their potential benefit to the society comes from the fact that they do increase productivity. To merely assume that a similar number of people will be employed building the technologies as will be unemployed as a result of the use of those technologies, I think, avoids the very critical question of how jobs will be generated and the social cost of the change.

In the robot industry today, for example, there are currently about 2,000 workers employed who last year produced about 2,200 robots. However, as the decade wears on, the robot is no more complex than an automobile. In fact, it is less complex for a wide variety of robots.

The same automated techniques that are applied in auto and other manufacturing industries will be applied in the robot industry as well. Therefore, as the volume of robot production increases, it will become possible to automate that industry, creating relatively few jobs, while the use of robots will obviously affect the employment in the user industries.

However, for those jobs that are created, the skill breakdown is quite interesting. 39.7 percent of the robot industry is composed of engineers and engineering technicians compared to 3.5 percent of the motor vehicle and equipment industry. Obviously, there are important training and retraining implications here with the changing skill mixture that is brought about in some industries as a result of these new technologies.

One final comment: Robots alone, or the lack of robots, have not been the primary failure of the U.S. manufacturing base in recent years. Obviously, robots are key to productivity in the future. There is no question about that, but to imply that the reason we are not competing effectively today is that the Japanese have more robots, I think, creates a false sense of crisis that diverts us from the real issue we have to face, which is the social responsibility that is necessary for the introduction of these technologies. If robots were the key, then the most successful U.S. auto manufacturer would be Chrysler, because they employ the most robots per vehicle produced.

According to the Department of Transportation, in 1980 Toyota had 720 robots, more than any U.S. manufacturer, but Honda, which enjoyed a greater percentage of success in the marketplace, had 5 robots. That is not the story for the future, but I think it is important to understand what the real implications of the failure of U.S. industries to compete has been, and in many cases the key culprit has not been the lack of technology.

For the future, I think we have to look at some hard choices. One of those choices is shorter work time, not a new idea, something that has been deployed since the industrial revolution to deal with the introduction of new technologies.

In the current economic and competitive climate, it would be easy to say, well, wouldn't this be inflationary? Wouldn't this mean that U.S. industries are no longer able to compete? Well, what are the alternatives? Will we be better off as a society if we have a permanent 7- or 8- or 10-percent unemployment rate? Shorter work time is not the entire solution, but I think it is one thing that has not been considered seriously and deserves serious consideration.

The full benefit of programmable automation can only be realized in an economy in which human beings have the opportunity for meaningful employment. The potential for social benefit is there. It is up to us as to how we use these technologies, as to whether or not these benefits will be realized.

[The prepared statement of Harley Shaiken follows:]

PREPARED STATEMENT OF HARLEY SHAIKEN

for a Hearing of the Subcommittee on Investigations and Oversight
Committee on Science and Technology
Wednesday, April 6, 1983

Robots, word processors, computer-aided design equipment, and electronic cash registers are being introduced in industries as diverse as supermarkets and locomotive factories. I would like to explore the way these computerized technologies or programmable automation affect the number and quality of jobs with a focus on manufacturing. The promise is certainly there for higher productivity and more creative work. But, the current deployment and use of these technologies, without regard to their social cost, threatens to head in a much different direction: job loss and less desireable work.

Let's first consider technological change and jobs. In a complex industrial economy, employment depends on more than technology alone. Other factors such as the rate of economic growth and demographics are central. And because of the complex and interrelated nature of these various factors precise employment projections are sometimes difficult to come by. These difficulties, however, should not obscure the unprecedented labor displacing potential of programmable automation.

With over 11 million people already out of work, the key question is not future displacement but the number of people who will never return to meaningful employment. While the pace of automation has slowed with the economy, recovery may unleash a pent up demand for automated equipment, leading many industries to hire new robots before rehiring laid off workers. The result could be a conversion of short term cyclical unemployment into long term structural unemployment, not enough jobs for the number of people who want to work. But, even if the economy performs well in the aggregate, regional dislocation is already a reality. Many manufacturing industries such as auto that weather the economic storm will do so by automating jobs not by creating them. And there is little infrastructure in place either to put idle capacity to alternative uses or provide comprehensive retraining. Cities such as Detroit, Toledo, or Anderson could become manufacturing Appalachias in the 1980's.

But, haven't we heard all of this before? After all, there were those in the late 1950's and early 1960's who predicted that long term unemployment would result from structural changes in production. And, before then, there have been countless fears of technological change causing unemployment. What, if anything, is different about the current situation? One central difference is that programmable automation, a far more powerful technology than previous forms of automation, is being introduced against a backdrop of slow economic growth. Without increased output, productivity growth could mean the same amount produced by fewer workers. Moreover, computers combined with telecommunications allow production to be decentralized globally where costs are lowest and conditions most favorable to the manufacturer, a further drain on employment as Atari has recently shown.

In the past, automation tended to be limited to one industry or at most one economic sector. But computers and microelectronics are a technology of information processing and control that can be introduced in virtually any workplace whether it is an office or a machine shop. In the factory, programmable automation has cut from sixteen days to one the time it takes to machine the frame for a General Electric locomotive motor; the company estimates productivity gains at 240%. The same technology in the office allowed a St. Louis bank to handle 35,000 more transactions a day with 10% fewer tellers. As a result, many workers are faced with an economic vise: they are pushed out of the factory by robots while there are too few employment prospects in traditional areas of opportunity such as the office.

The scale of investment in both areas could be awesome. General Electric predicts that the market for factory automation could be $29 billion annually by 1991, up from $4 billion in 1981. Dataquest, a business consulting firm, predicts that the market for all electronic office equipment could grow by 34% a year through 1986. Word processors alone will likely become a $6 billion a year industry by 1986, up from $2 billion a year in 1961.

In manufacturing, microelectronics not only makes possible a more productive production process but the product itself becomes simpler to assemble and manufacture, generally while its functions become more sophisticated. The result can be plummeting labor requirements. National Cash Register, for example, found that it needed only 25% as much labor to produce electronic cash registers compared to their electromechanical predecessors. This contributed to a work force reduction at a time when sales were expanding in the late seventies.

Overall, if productivity rises by 5% in an industry over a ten year period, all other things remaining equal, then 39% fewer workers are needed to produce a given product. Of course all other things seldom remain equal but some companies are targeting gains of this magnitude with programmable automation.

As the costs of the technology continue to decrease while its sophistication increases a range of industries could choose to automate that have traditionally relied on labor intensive, although low paid, methods of production. One private research laboratory modeled an automated system several years ago for a mid-west manufacturer that had a total wage and benefit cost of $5 an hour. While automation was not cost effective at the time, the researchers concluded that it would be in the near future.

This expanded capability could have important implications for those areas where large numbers of jobs were created in the 1970's. Since 1973, for example, 10 million jobs have been created in services, retail trade, and state and local government. Traditionally these areas have been immune to automation but in some areas this may no longer be the case.

Counterbalancing these trends, programmable automation makes possible new services, new products, and even new industries, all of which create jobs. The entire video game industry, for example, hardly existed several years ago. And of course jobs can be found building these new technologies. But, will enough jobs be generated to compensate for those that are eliminated? And what will the time frame and access to these jobs look like? In a recent issue Business Week projected that high tech, long regarded as a white knight for employment, would only create in the next decade less than half of the 2 million manufacturing jobs lost in the last three years.

Consider the employment effects of only one of the many new manufacturing technologies, the robot. Many analysts believe the industry will grow to $2 billion a year in sales by 1990, up from $200 million in 1981. If peripheral systems are included total sales would be about $4 billion annually by 1990. As impressive as these figures are, they amount to less than 15% of what GE projects the total market for factory automation will be. Nonetheless, the impact of robot sales on employment could be critical because they are concentrated in relatively few industries which in turn are concentrated in several geographical regions. Auto remains the major user of robots with over 25% of all robots in use and 80% of auto production is concentrated in 5 midwestern states. General Motors alone could purchase over 20,000 robots in the next ten years. Currently, a robot in a two shift GM assembly plant eliminates about 1.7 workers and in a three shift manufacturing plant about 2.7. This is on a net basis, that is after all the workers who install and service the robot are factored in. This one technology alone could displace the equivalent of 40,000 jobs, a figure that is near the current hourly employment of the Chrysler corporation.

In is highly unlikely that employment in the robot industry itself will generate anything but a small fraction of the jobs that are eliminated. This shouldn't be surprising since robots are supposed to be a labor displacing technology. There are currently about 2,000 workers employed in the industry, producing about the same number of robots annually, but as volume rises production efficiencies could soar. In other words, robots could be building robots.

Of particular importance is the structure of the robot industry compared to user industries such as auto where the displacement will be occuring. 39.7% of the robot industry is composed of engineers and engineering technicians compared to

3.5% of the motor vehicle and equipment industry. This implies a high degree of retraining for the few workers who are able to make the transition.

Less obvious than robots are the indirect effects on employment of computers and telecommunications. These technologies make possible an infrastructure capable of decentralizing even the most complex of manufacturing operations worldwide. An engineer sitting at a computer terminal in Sao Paolo and an engineer at a terminal in Detroit , for the purposes of design and manufacturing coordination, are sitting in the same room. Combined with other economic pressures this is leading to a large outflow of production in industries such as auto. One study done by the University of Michigan predicts that 35% of all content of US assembled autos could be imported by the 1990's.

The second area I would like to briefly touch on is the character of the jobs that remain. The versatility that characterizes microelectronics offers a wide range of possibilities for organizing work. Some of these possibilities provide more creative jobs and increased worker decision-making, other options result in more routinized work and new forms of electronic monitoring and control. Much depends on the purposes for which the technology is designed, deployed, and used.

Iron Age magazine, a leading metalworking weekly, tells us many managers view new technology as a vehicle to increase managerial control over the workplace. Describing flexible manufacturing systems (FMS), a highly advanced and integrated approach to computerized metal working, Iron Age comments:

> ....labor's role in manufacturing, particularly as regards control over production rates and product quality, is being thoroughly reexamined. Workers and their unions have too much say in manufacturing's destiny, many metalworking executives feel, and large, sophisticated FMS's can help wrest some of that control away from labor and put it back in the hands of management where they feel it belongs.

These kind of purposes lead to a production process characterized by a centralization of creative decision making at the top, a removal of skill from a wide range of occupations, and new forms of electronic control. While a small number of jobs at the top may become enriched, many other occupations become diminished. An example of this is the use of computerized machine tools or numerical control (NC). The decisions formerly made by a highly skilled machinist are now made by a designer sitting at a cathode ray tube, in the most advanced systems, and the machinist becomes an observer of the process. Not only does the work become less interesting, but since skills are not generally called for, they may not be there when they are needed. The result is a production process that operates at far from its full potential.

In conclusion, the real question we face is how to deploy and develop new forms of automation in a socially responsible manner. While robots are capable of automating many operations, addressing this issue requires conscious human intervention. The underlying principle should be the linkage of technological change to benefits for the workers that are affected and the communities in which they live. This means distributing part of the productivity gain in the form of reduced work time and serious retraining benefits. It also means the design of systems that can fully utilize the human potential available rather than those that extend workplace authority. As a society we will not be better off if programmable automation is used to make some firms more competitive at the expense of sustained job loss. The full benefits of programmable automation can only be realized in an economy in which human beings have the opportunities for meaningful employment.

Mr. GORE. Thank you very much.

The final witness on this panel is Judith Gregory, research director for 9-to-5, the National Association of Working Women.

Ms. Gregory, we welcome you here. Please proceed.

STATEMENT OF JUDITH GREGORY, RESEARCH DIRECTOR, 9-TO-5, NATIONAL ASSOCIATION OF WORKING WOMEN

Ms. GREGORY. Thank you. I am very honored to be here, also, in this important hearing this morning or afternoon. I am not sure which it is.

Mr. GORE. It is still morning.

Ms. GREGORY. 9-to-5, the National Association of Working Women, is an organization of 12,000 women officeworkers across the country with more than 17 chapters in every State in the United States. In my written statement I have touched and commented on the employment projections of the Bureau of Labor Statistics. I will be submitting a further testimony on some of the research in progress, on the effects on skills and the quality of employment.

The media loves to tell story after story of the secretary who has overcome her Freudian fears and learned to love her Wang or her Lexitron. The reality for many officeworkers is not so rosy. When we talk about statistics, projections, forecasting, it is easy to forget about the people whose lives make up that composite.

The two examples I am going to describe both come from the insurance industry, which is both clerical intensive and computer intensive and a growth industry.

The first touches on the quality of employment and the second gives a sense of some effects related to the quantity of employment even within the growth industries.

At Equitable's insurance office in upstate New York near Syracuse, 90 women work at video display terminals virtually all day as claims processors. They have flexitime, but they also have mandatory overtime. They are often scheduled for five or six consecutive 10-hour days. They get no rest breaks during 8 hours at the terminals. They are mostly women under 35 who have children or are planning to start families. Their full-time pay in 1982 averaged $9,500 before taxes, and many held second jobs to make ends meet.

In the last 3 years in which VDT's have been introduced in their workplace they have experienced many changes in how they do their work, their understanding of the work, and their sense of their own skills. They are also confused about the way that they are now paid. The procedures and methods for handling claims have changed constantly, five times in one 6-month period, but one factor is constant: Every time the amount they are supposed to produce goes up.

My second example is related to Blue Cross-Blue Shield in the greater Boston area. Recently, our Boston group of 9-to-5 was told by a claims examiner who works for Blue Cross-Blue Shield that the company has moved some of the bulk clerical work or back office processing work out of the city and into the suburbs to two locations, Plymouth and Rockland. At the same time the company changed the work from a salaried job to an hourly wage. They also changed the work from 37 hours to 30 hours or less for the employee.

In the office where Adrienne works, there are 65 women on the day shift and 45 on the night shift. The company also eliminated the insurance benefits. Now that is what I call management's idea of the 30-hour workweek that undermines the spirit of the remedies we need, the kind of job-sharing ideas that we have been hearing about this morning.

We believe there is a dual nature to office automation. Like Dr. Jekyl and Mr. Hyde, it can be benign. It has had good effects for many, many officeworkers. Because it is a growth area, policymakers and employers can emphasize measures to assure a good quality of work, but it also has a dark side and that must be addressed as well. Unlike the demon Mr. Hyde, we can and must control the negative and painful effects of new technology.

One of those, looking ahead, that will be facing us is reduction in the number of jobs in the economy as a whole. In terms of clerical employment, there is no question that there is job growth in this vast work force. The predictions are for 20-percent increase in jobs, more than 4 million jobs projected as new jobs between 1978 and 1990. Yet, we feel that that employment growth is masking the powerful labor-reducing tendency of the technology as it evolves.

In other countries studies have predicted reduced labor requirements. In other words, not reduced jobs per se in the economy overall, but a jobless growth, no longer a need to hire more people.

To give you one example, in one of the most sophisticated studies done on computerization as a whole, the Austrian Government analyzed input-output data to project the impact of new technology and found that implementing 1980 technology throughout the country by 1990 would lead to the largest increase in output but also to the highest unemployment, 10 percent, that Austria has seen since the 1930's.

If the workweek is shortened to about 35 hours per week in that country from an average of 42 hours per week now, however, the Government predicts that unemployment could be controlled to remain at about 2 percent.

Other countries have predicted job displacement effects for office workers of 15 to 30 percent. I think we must ask if we are so different, what makes us so different? We need an explanation of these trends from our Department of Labor.

Trends which lead us to believe that the labor-reducing aspects of office technology will accelerate include the following:

One is that we are in a period of intensive transfer from paper to electronic forms for paperwork. In the short term on a company level this means that very often extra data entry workers are hired to carry out that transition, so you can have a temporary increase in the number of clerical jobs but, once that work is entered, as anyone who has worked with those kinds of files knows, yes, there is maintenance work and processing work but there is a drastic dropoff in the original work involved in making that changeover.

Second, the big leading companies have gone beyond the pilot project stage of office automation and are implementing office technology throughout their companies.

Amy Wahl of Advanced Office Concepts estimates that 2 to 5 years after a company introduces automation the effects and the potential for job displacement begin to appear. She identifies 1987 to 1992 as a critical period as a significant number of companies enter that phase.

A third factor has to do with a study in progress by the Rand Corp. that has partial funding from the National Science Foundation. It looks at advanced office automation systems in over 55 companies.

One of the criteria for this study when it began was that the company had to have been working on an advanced office system for 6 months. That was 2 years ago. Those systems were not in the workplace in a significant manner as short a time ago as 2 to 3 years.

That kind of change is related also to what one commonly hears—companies have a goal of going to one terminal per one person. By that, they mean personal computers, word processors, and other kinds of display terminals.

The direct entry and processing of information by professional and managerial level workers, then, will also have an effect on reducing the need for clerical support personnel.

A fourth study in progress which I would like to point the committee's attention to is called The Innovative Word Processing Project. One of the participants in it is Dr. Bonnie Johnson. Again, it has some support from the National Science Foundation.

In this study of over 200 companies, both public and private, one thing is especially consistent. Every single company or organization in the study says that they are doing their damnest to reduce their staffing levels through computerization.

If we understand what is happening on a company level, this must add up.

The second area has to do with reliability of the BLS projections. I have comments in my written statement and I just want to raise two points here.

One is that the predictions of vast employment growth in clerical work are hard to trust in the fullest. Although we believe there will be vast increases, it is hard to trust the complete figures when the assumption is of a 4- to 6-percent unemployment level during a decade when we are seeing a persistent 10-percent official rate of unemployment.

Second, the BLS predicts that bank clerks will increase by 50 percent, going from half a million to three-quarter of a million workers between 1978 and 1990. This is at a time when the banking industry predicts that 50 percent of all transactions will be handled by what they call nonhuman tellers in the same decade.

Therefore, we are left with the question, who do we believe?

A third area I want to mention is that, from concern on these issues, 9-to-5 and the Working Women Education Fund, with support from the German Marshal Fund of the United States, held a First International Conference on Office Work and New Technology in Boston last October. The proceedings from this conference, both on research and policy initiatives in Europe, Canada, and the United States, will be available in May.

One of the most striking comments and bits of information that was brought to us came from England. Robin Dacey, on the research staff of the Banking, Insurance, and Finance Union in London, pointed out that just between 1981 and 1982 Midland Bank, 1 of the biggest 4 banks in Britain, declared that it intended to lay off 2,000 staff. This was unthinkable, again, as short a time as 3 years ago.

Prudential Insurance in England announced that it was cutting 400 staff and had intentions to consolidate further in other offices. That company had never before declared a person redundant, as they say, and laid someone off.

Again, if this is a pattern in another country, how does our banking industry compare or not compare?

Another issue that we are seeing is a polarization of employment, and it has been noted by several researchers. There is, yes, a creation of highly technical jobs at the top of the employment structure but a much more rapid expansion of semiskilled and lower level jobs at the base. This kind of thing threatens to leave women and majority workers who are most in need of advancement behind.

There are those who suggest that the trend will be toward a flattened job structure. Paul Strassman is one of those predictors or observers. On the surface a flattened job structure sounds more egalitarian.

These two trends, the polarization of employment and the flattened structure, may not be completely contradictory. We believe it is important to consider that a collapsed job structure may follow a period of polarization.

What this kind of thing will mean for clericals, again, at a company level it can mean a massive loss of jobs for those at the lowest levels. Second, it may mean a deprofessionalization of middle-level jobs, meaning that clerical workers move up as the jobs move down, in a sense.

As far as the impact of office technology on skills and the quality of employment, there are right now contradictory findings. It is an area of flux and an area of debate.

For example, sociologists Rosalind Feldberg and Evelyn Glenn of Boston University found job deskilling as the major trend in their studies of New England companies implementing office automation, deskilling for women clericals, but they also found different effects on different employees during different stages of office automation.

Even in the jobs such as processing jobs that are considered to be improved, they found that because of managerial controls and work production monitoring by computer, employees often experienced less control rather than more autonomy, even in these jobs where their responsibilities had been broadened.

In another study, a case study of legal secretaries, among the highest status jobs in clerical work, Mary Murphy of Columbia University found that the content and skills of these jobs were stripped away gradually and assigned to different workers both above, paralegals and other paraprofessionals, and below, word processing specialists. The jobs went from being in high demand

and very secure to being insecure and tenuous in a short period of time.

Her study challenges the notion that it is only low-skilled jobs that are affected by office technology.

However, in the area of skills and the effects of office automation, there is no question that there are new skills involved in clerical work that are not yet being given their full due. The way that these two pieces of the puzzle fit together, we believe, is the chronic undervaluation of clercial workers' jobs and contributions, the intersection of office automation and the movement for pay equity or comparable worth, if you will.

Again referring to Bonnie Johnson's study, The Innovation and Word Processing Project, she notes that—and this is a survey of over 200 organizations—word processing operators represent a substantial untapped resource for technology utilization in the country. Word processing is best used when productive applications are developed and spread, and yet only 8 percent of the word processing operators in the study were ever given time to experiment to find new and better applications on their jobs while the majority would like to do so.

In those rare places, she notes, where operators had been expected and supported in developing better uses, substantial improvements have been made in the productivity of the organization and the career of operators both.

One final note from the comments she prepared: in the Federal Government where word processors have been put out like typewriters, the problem of underutilization of human resources is most acute.

One thing I would recommend, based both on our knowledge of what clerical workers do, the kinds of hidden problem-solving, intellectual tasks, and the kinds of findings from Johnson's study, is to suggest that the Dictionary of Occupational Titles itself needs reevaluation as far as what people actually do in this new era of computer technology.

In summary, I just want to go back to the overall employment questions that are being addressed today. First, in criticizing the BLS projections, I want to emphasize that 9-to-5's view is that more resources need to be allocated to the Bureau and that, in fact, we feel that BLS data collection has been jeopardized or limited by severe budget cutbacks just at a time when new analysis needs to be intensified and expanded to understand a rapidly changing technology.

Finally, we believe that in the near future—and to say that we may have 10 to 15 years more of growth in the office sector is to say that we have time to plan but not endless time—we must face very difficult questions.

First, if employment growth is slowed in the services industries as a result of technological change, where will new jobs come from in the economy of the future?

Second, where will women find jobs as they continue to move into the workforce at an extremely rapid rate?

Third, who will have access to the new jobs created and what levels of jobs will they have?

These are critical questions which we believe will require the immediate attention of policymakers and will require the development of both humane government and corporate policies.

I have attached, for the committee's consideration, recommendations for action on office technology, one of which is to undertake as soon as possible a review or survey of policies both on job creation through new technology and policies to address job loss being initiated or implemented in other countries.

In closing, I would like to commend you for your efforts today and thank you for the opportunity to testify. Thank you.

[The prepared statement of Judith Gregory follows:]

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Testimony of 9 to 5, National Association of Working Women

Before the Subcommittee on Investigations and Oversight, U.S. House of Representatives
of the Committee on Science and Technology

Presented by Judith Gregory, Research Director
April 6, 1983

I am pleased to present testimony on behalf of 9to5, the National Association of Working Women, on the impacts of office automation on the quantity and quality of employment. 9to5 is a membership organization of more than 12,000 women office workers, with more than 17 chapters and members in every state across the U.S. In March, 1981, 9to5 joined with the Service Employees International Union (SEIU) to create a new union for clerical workers, District 925/SEIU. Both 9to5, the NAWW, and District 925 have been deeply concerned with the issues posed by new office technologies for clerical workers in particular, and society at large.

From the beginning, I want to state 9to5's view that office automation provides opportunities to find solutions to long-standing problems which have plagued women office workers: low pay, dead-end jobs and underutilization of skills, sex and race discrimination, stressful working conditions. Office automation can and should be used to enhance jobs, provide opportunities for advancement of women clericals, provide a healthier and more satisfying work environment, and improve our overall standard of living. If applied with social criteria and goals in mind, new technologies, we believe, have the potential to create jobs and make services more broadly available, improve the quality of working life, address discrimination and upgrade skills in an unprecedented way.

The rhetoric sounds good, but the reality is not so nice for the majority of office workers. There is a dual nature to office automation, like Dr. Jekyll and Mr Hyde: will automation be implemented to bring about a future that is better or worse for office workers? There is a critical role for public policy-makers to play in how this question will be answered. Unlike the demon Mr. Hyde, we can exert control over the dark side of automation, and we must. To do so, problems need to be faced squarely.

In previous testimonies in the past two years, I have presented and documented a full range of current and future problems raised by office automation from the perspective of clerical workers (Testimony for 9to5, Natl. Assn. of Working Women "New Technology in the American Workplace," U.S.H.R. Subcommittee on Labor Standards, June 23, 1982, and Testimony, Working Women Education Fund, "The Human Factor in Innovation and Productivity," U.S.H.R. Subcommittee on Science, Research and Technology, September 16, 1981).

In my written statement, I focus on the potential for job-loss in the not-so-distant future, "jobless growth," the reliability of current BLS projections, and considerations which need to be taken into account in assessing future employment trends and policies.

Effects of Office Automation on the Quantity of Employment

The need to question the effects of automation, to define a more accurate picture of the future, is crucial. Not only because the future is so close at hand -- we are talking about the next 5 to 10 years, the next generation of work-- but also because the historical role of the service sector as an area of new employment, particularly since World War II, appears to be that of a last frontier. In 1948, for example, manufacturing employment accounted for about one in three jobs in the U.S. Today, fewer than one in four workers are employed in goods-producing employment. Clerical workers have supplanted factory operatives as the largest -- and still growing -- occupational group in the U.S. workforce. Today clerical workers number 18 million plus.

The U.S. Department of Labor predicts continued, explosive growth in clerical jobs, estimating that there will be 4.6 million new jobs created for clerical workers, or nearly one in four of all new job creation to 1990. Nearly 700,000 new secretarial jobs are expected to be created between 1980-1990; nearly one-half million sales clerks jobs; 187,000 new typists' jobs; 167,200 additional bookkeeping jobs--these are some of the most striking predictions, and they are dramatic.

However, we believe that the continued need for clerical workers, and the vast size of this workforce, appears to be "masking" the potential job-displacing effects of automation in office industries. While employment in banking is still expanding, for example, the rate of job growth slowed from 4.5% annually from 1960 to 1973 to 3.2% a year from 1973 to 1976, while the volume of transactions continued to climb steadily. In other words, it takes fewer people to do more work. Yet these figures are from an era before more recent, and more powerful, technological changes introduced in banking.

Banking and insurance have been "growth" industries, during a period when other industry sectors lacked similar advantage. Yet most industry observers note that the finance industries are in competitive era preceding a period expected to involve intense consolidation and concentration. Experts predict as many as 20,000 of the nation's 65,000 independent insurance agencies will merge, sell out or go out of business in the next decade, for example ("Insurance Relying More on Automation," by Daniel Hertzberg, Wall Street Journal, 11/9/82). Banks are expected to undergo concentration, some predict 25% to 30% reduction in the number of commercial banks within the decade, as well. New technology plays important roles in both the period of competition, enabling the creation of new profit-making services, and in the period of concentration to follow, eg. the role of electronic funds transfer (EFT) systems in facilitating a likely move towards national banking.

Predictions of Technological Unemployment in Other Countries have been made in a number of studies, both public and private. To cite a few:

- A study by the Siemens Corporation, which covered 2.7 million office jobs, predicted that 43% of the jobs could be standardized, and 25%-30% automated.
- A British study estimates that office automation and other computer-based forms of automation in the service industries could contribute to a structural level of 20% unemployment in the U.K.

- The Nora-Minc report for the French government predicted that: "In banks, the installation of new computer systems would permit employment reductions affecting up to 30 percent of the personnel over ten years, but this does not mean that workers would have to be discharged. In effect, these reductionsare a measure of the numbers of additional personnel that would be required under current rates of productivity to meet the coming demand, and telematics would make additional hiring unnecessary.... In insurance, the phenomenon is even more pronounced. Job savings of approximately 30 percent are now possible within 10 years." (Computerization of Society, by Simon Nora and Alain Minc, MIT Press, Cambridge, MA, 1980).

- Heather Menzies, in her study of Canadian women workers for the Institute for Research on Public Policy, estimates that: "with fast diffusion and high productivity [of microelectronic technology,] female clerical unemployment in 1985 could reach as high as 16 to 26%... if the present proportion of working women continues to seek clerical employment. Under the same conditions,the unemployment rate among female clerical workers could range from 25 to 41 per cent." (Women and the Chip, by Heather Menzies, IRPP, Montreal, 1981.)

- The Austrian government recently conducted a major study, analyzing input-output data. to project the impact of new technology, and found that implementing 1980 technology throughout the Austrian economy by 1990 will lead to the largest increased in output, but also to the highest unemployment (10%) that Austria has seen since the 1930s. (If the workweek is shortened to about 35 hours/per week from 42 hours/per week, however, unemployment could be controlled to remain at about 2%.) (See: Wassily W. Leontief, "The Distribution of Work and Income," Scientific American, September 1982.)

These studies give us serious warning, and underscore the need to re-evaluate the reliability of U.S. Department of Labor projections.

BLS Projections: How Reliable Are They? A study prepared by the General Accounting Office last year summarizes projections of job losses and growth related to technological change (Advances in Automation Prompt Concern Over Increased U.S. Unemployment, GAO/AFMD-82-44, May 25, 1982).

Among office occupations, the BLS predicts continued increases in most office jobs; including: bookkeeping operators (12% growth to 1990); file clerks (23%); insurance claims representatives (41%), office machine operators (5-15%). All of these represent slower growth rates due to automation, although all also represent large numbers of jobs created, as noted earlier.

Among the projections of the BLS, however, are two predictions which cause us to regard the data with scepticism:

- The projections are based on an assumption of an unemployment rate between 4 to 6% -- difficult to trust in this era of official unemployment or 10% or more.

- Bank clerks are predicted to increase by 50% (from 505,000 in 1978) -- also difficult to accept, as we see more and more automatic teller machines (ATMs) around us, and in fact the banking industry predicts that 50% of all bank transactions will be performed by "non-human tellers" by the end of the 1980s.

The projections do not adequately account for either the recession or the impact of technological changes.

The Strengths and Weaknesses of the BLS Projections and Methods

9to5 consulted Dr. David Howell of the Institute for Economic Analysis in New York City, for a critique of the strengths and weaknesses of current systems used by the BLS to estimate future employeemtn patterns. Following is a statement prepared by Dr. Howell for this testimony:

"While the BLS remains the most reliable source for systematic economy-wide projections of occupational employment, the quality of these projections could be vastly improved with additional resources devoted to the program. The current changes that are taking place in industry and occupational employment underline the urgency of improving the quality of these projections, in order to develop policy that would soften the impact of job loss, and better meet the education and training requirements of the future.

The BLS employment projections rest upon two basic inputs: projections of industry employment and projected occupational staffing patterns by industry (i.e. the occupational composition of each industry). The focus of these comments is limited to the projections of staffing patterns.

BLS develops industry-occupation matrices from the Decennial Census of the Population, and extrapolates the trends given by these data to a future year. For example, the employment in an industry-occupation cell for 1985 was derived from its trend between 1960 and 1970. (The projections for 1990 are derived from trends between 1970-78.)

There are several obvious problems with this approach. First, for those industry-occupation cells for which the end point years do not describe the actual trends for the intermediate years, this method will produce meaningless results. Even if there was a means for identifying the cells with a problem, according to a BLS staff paper, "it is unlikely that the majority of these would be discovered given the size of staff available to conduct the analysis..." ("Projected Occupational Staffing Patterns of Industries," BLS Office of Economic Growth and Employment Projections, April 1981).

A second problem is that even if we assume that these trends are accurately measured, they may not be good predictors of trends in the following decades. Adjustments made by BLS to take into account the effects of technological change have been minor and undocumented. The example of drafters highlights the problems that surround simple extrapolation of past trends. While computer-aided design (CAD) is expected to wipe out most drafter jobs by 1990, the BLS Occupational Outlook Handbook for 1980-81 based on employment projections concludes that "Employment of drafters is expected to increase about as fast as the average for all occupations through the 1980s...."

Unfortunately, even for those occupations that have been recently singled out for special attention, the revisions that have been made are undocumented (eg., see: Employment Trends in Computer Occupations, October 1981, BLS Bulletin 2101).

The shift by BLS from reliance upon Census of Population data to the occupational employment statistics (OES) survey data, which is available every 3 years, should significantly improve the quality of the extrapolations. I hope that resources for this new survey program (OES) are continued.

Finally, I urge that more extensive documented revisions will be possible in the future employment projections by the Bureau."

In criticizing the BLS projections, I wish to emphasize 9to5's position that more resources need to be allocated to the Bureau, and the Department of Labor generally, to analyze the impacts of technological change on U.S. employment and incorporate research findings into the methods used for future estimates of employment. Improvements in BLS methods are urgently needed, if we are to develop a better picture of future trends in employment. Unfortunately, BLS data collection has been jeopardized or limited by severe budget cutbacks, just at a time when we feel that analysis needs to be intensified and expanding to understand a rapidly changing economy.

Summary

In summary, we must face very difficult questions in the near future:

- o If employment growth is slowed in the services industries as a result of technological change, where will new jobs come from in the economy of the future?
- o Where will women find jobs as they continue to move into the workforce at a rapid rate?
- o Who will have access to new jobs created, and what levels of jobs will they have?

These are critical questions which require the immediate attention of policy-makers, and will require the development of humane government and corporate policies.

I have attached 9to5's Office Automation Bill of Rights, and Recommendations for Action on Office Technology for your consideration.

We commend you on your efforts, and thank you for the opportunity to testify before you this morning.

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OFFICE AUTOMATION BILL OF RIGHTS

If you were to draw up an Office Automation Bill of Rights for the office of the future it might read like this:

(1) To use more skills - not fewer.

(2) To have more control over the pace and organization of work - not less.

(3) We can exercise more judgment - not less.

(4) We are protected from health hazards.

(5) We are trained in the use of the system.

(6) We participate in the design of the system.

(7) We are compensated for our high productivity.

(8) We share in the benefits of technology.

10 YEARS OF WINNING—10TH ANNIVERSARY—RIGHTS AND RESPECT

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RECOMMENDATIONS FOR ACTION ON OFFICE TECHNOLOGY
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9 to 5, National Association of Working Women, believes that strong federal action is needed to protect office workers from the adverse effects of current forms of office automation, and to create a climate in which the introduction of new office technology can benefit workers at all levels. Abundant evidence of widespread occupational health effects — particularly increased job stress, visual, musculoskeletal, and nervous system problems — associated with continuous VDT (video display terminal) work under poor working conditions must be addressed with protective legislation.

Such action by Congress is urgently needed for several reasons: 1) Employers do not willingly take actions needed to protect office workers' health and well-being; 2) More than 90% of all U.S. private sector clerical workers, and more than 80% of public sector clericals, lack union representation and therefore do not have access to collective bargaining as an avenue for improving working conditions or challenging unfair management practices; 3) Office automation is being introduced so rapidly that action must be taken now before irreparable harm is done to office workers' jobs, health and quality of working life.

9 to 5 calls on the Congress to take the following actions:

1) Ensure all U.S. workers certain basic rights in relation to new technologies, to include:

   - The right to advance information about plans for new computer systems before decisions are made;

   - The right to relevant training and education during working hours, with employers providing "release time" with pay;

   - The right to participate in systems design, and the right to funding support to choose technical consultants of their own;

   - The right to have "technology representatives," chosen by workers, who receive special training needed to represent workers' interests and concerns about new systems.

   - A protected right to refuse to work with new computer-based systems if they have not been consulted, if workers' concerns have not been met, and if employers are abusing new technology in ways which devalue, deskill or degrade jobs, adversely affect health or otherwise undermine working conditions.

2) Act to protect the occupational health and well-being of office workers by adopting proposed Norwegian regulations limiting work at video display terminals (VDTs) to 50% of the working day. in order to promote good job design.

Furthermore, we urge the Congress to adopt sections of the Norwegian Work Environment Law which require employers to reduce monotony and repetitiveness in work, especially prevalent problems in automated office work.

3) Adopt the following measures for all public sector clerical workers using [illegible] (CRTs), to serve as a model for private sector employers:

- The proposed Norwegian regulations on work organization in VDT work;

- The National Institute for Occupational Safety & Health (NIOSH) general recommendations to reduce potential health risks of VDT work, including provisions for rest breaks (15 minutes per 2 hours of moderately demanding VDT work; 15 minutes per hour of visually intense, high workload and/or highly repetitive VDT work.)

(See "General Recommendations," NIOSH Research Report, Potential Health Hazards of Video Display Terminals, DHHS (NIOSH) #81-129, June 1981); Federal, state and local governments should use their purchasing and legislative power to ensure the quality and safety of equipment for public employees.

- Adopt 9to5's recommendations to employers and public officials, from The Human Factor (9to5, National Association of Working Women, 1982).

4) Restrict computerized monitoring of individual work performance, or other methods of computer-controlled pacing and measurement of work, as an invasion of workers' right to privacy.

5) Direct the U.S. Department of Labor to provide funding support for training initiatives on new technology, especially programs which will benefit those most in need (women and minority workers, older displaced and re-entry workers, and the technologically unemployed) and particularly programs in growth industries where automation is occurring rapidly, such as the service and finance industries.

6) Further, direct the Department of Labor to conduct studies to assess the impact of computer technology in key industries such as banking and insurance. Such studies should be designed so that they do not rely solely on employers for data and should examine such issues as:
—the effects of automation on the pay scale, job descriptions and promotional opportunities of women and minority workers already concentrated at the low end of the pay scale;

--the particular impact on longterm and older employees;

- impact on turnover rates;
- impact on incidence of involuntary part time, shiftwork, and piece-rate work;
- potential employment displacement effects by occupation and by industry sector;
- Effects of centralisation, monitoring and machine-pacing of work;
- effects of decentralisation of office work, and increased "office mobility;"

7) Conduct a study to assess the practices and responsibilities of the computer industry, to examine issues including:

- safety in design of video display terminals;
- practices of computer industry sales personnel which promote negative trends such as workplace speed-ups, excessive monitoring, inadequate training, specialization and centralization of jobs, elimination of skilled jobs;
- delay and suppression of technological innovations and improvements;
- employment practices of the computer industry itself, regarding women and minority workers and the occupational health and safety of microelectronics assembly workers.

8) Review the state educational system, its programs and capabilities, in light of the impacts of computer technology.

9) Survey labor organizations to identify problems of their members, their concerns and suggestions for solutions to problems of new technology.

10) Survey policy alternatives being considered and implemented in other countries regarding technological change, particularly policies to address future job displacement, and initiatives to use advanced technology to create jobs.

The Human Factor

9to5's Consumer Guide to Word Processors

Effects of Office Automation
One-third of today's 42 million working women are clerical workers. The number of those using word processors daily is growing rapidly. At least 5 million machines are now in use in such industries as publishing, insurance, banking, and law. The number of users could grow to 10 million by 1985.

The potential advantages of the automated office are many. Information could be processed more quickly and efficiently, production could be increased, and office workers could be freed to take on more challenging tasks.

The many potential disadvantages, however, require attention. Studies reveal that back and neck aches, eyestrain, headaches, and nausea are among the symptoms experienced by VDT users. Pregnant women may be especially at risk for serious health effects. The application of automated equipment may also be used to redesign, and to downgrade, the jobs affected. The checklist with which 9to5 evaluated automated equipment was developed with these concerns in mind.

"Ergonomic" features, those that affect the user's environment, must adjust the equipment to the user. Adjustable screens and detachable keyboards help to alleviate back and muscle strain; glare-reducing glass or shields help to reduce eyestrain and headaches. Printer covers or sound hoods are important features in reducing noise. Both the terminal casing and keyboard should be of a matte finish (nonreflective) to reduce glare.

Video display terminals (VDTs) are technically cathode ray tubes (CRTs) around which word processors are built. Increasing concern has focused on the long-term health effects of exposure to low-level radiation emitted by CRTs. Scientists cannot fully explain either the recent series of "clusters" of miscarriages and birth defects among pregnant VDT/CRT operators in the United States and Canada or the previously reported cataracts among users. Limited government studies have found radiation emissions from display terminals to be well below federal standards, yet both the current legal exposure limits and the methods of measurement have been criticized. As a minimum precaution at this time, screens should be enclosed in metal casing designed to block as much radiation leakage as possible.

9to5's Study
9to5, National Association of Working Women, has developed "The Human Factor" to provide potential buyers and users with comparative information about safety and user comfort features of automated office equipment. The guide was compiled by 9to5's Boston affiliate.

In this study, we focused primarily on manufacturers located in the Boston area. For each model evaluated, we conducted an on-site visit with a company representative available to show us the equipment and to answer questions. In some cases, the representative was well informed, but we were surprised to discover that many were unaware of the health and safety concerns of users. We looked at only one model per manufacturer. The model number is clearly noted in the center table. Our evaluation is of this model only, not of the manufacturer in general. In some cases, we were shown the manufacturer's most current model, not necessarily the equipment most often used by office workers.

"The Human Factor" is an important first step in guiding purchasers in the selection of high-quality equipment. The results are not an endorsement of any product. We urge all purchasers to use criteria here in evaluating the health and safety features of any models considered for purchase.

*Preferred feature	**DIGITAL** Model #VT278 Decmate	**HONEYWELL** Model #7803	**IBM** Displaywriter	**LEXITRON** Model #VT1303	**PHILLIPS** Model #2001 or #2002	**PRIME** Model #PT65	**SAVIN** Model #IS2000	**SYNTREX** AQII	**T.I.** Model #940	**WANG** Wangwriter
Ergonomics										
Screen Tilt										
up/down										
side/side					✓					✓
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
neither		✓		✓		✓			✓	
Printer Dust Cover/ Sound Hood										
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
optional	✓	✓		✓	✓	✓	✓	✓		✓
Printer										
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
not detachable										
distance capability		5 ft	200 ft	25 ft			10 ft	3-4 ft	6 ft	10 ft
optional	up to 1000 ft	4000 ft		4000 ft			✓			✓
Keyboard										
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
not detachable				✓						
Screen										
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Optional Glare Shield or Filter	3 types	✓		free on request				filter	✓	
No Optional Shield or Filter										
Character Size				not available					not available	
>3 mm*	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
3 mm										
< 3 mm		lowercase				lowercase		✓		
Dot Matrix										
>5 × 7*	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
5 × 7	✓					7 × 11 lowercase				
< 5 × 7										
No Visible Flicker or Jitter	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
adjustable by operator	brightness	brightness	brightness and contrast	brightness	brightness	brightness	brightness	brightness	brightness	brightness
Color (Screen/Letters)	white on grey	green on black	green on black	light green on dark green	green on black	white on dark grey	light green on dark green	white on black	black on white or white on black	light green on dark green
Machine Construction										
Hardware Enclosure										
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
plastic	✓	✓	✓	✓	steel)	✓	✓	✓	✓	✓
Casing Finish										
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
shiny										
color	beige w/ black	white w/ black	pearl white	putty	off white	putty/grey	grey	putty	grey	beige/grey
Keyboard Finish										
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
shiny	keys	keys								
color (keyboard/keys)	black/black	grey white	pearl white	brown/putty	beige/brown	putty/grey	putty/black	putty/black	grey	keys grey/grey
Exhaust Ventilation										
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
side/side	of machine						✓	side of disc drive		
back	of printer	✓		✓	✓		✓	side of typewriter		✓
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
TYPE forced	✓	✓		✓	✓	✓		✓		✓
other		(fans in back convention on top)				w/ fan	w/ fan	(fan in back of printer)	✓	fan in rear

Well-designed equipment is only the first step in assuring a safe, healthy, and productive work environment. The implementation of automation in the workplace is of equal, if not greater, importance. The new technology should relieve office workers of repetitive work, upgrade skills, and increase promotional opportunities. Following are 9to5's recommendations for purchase and implementation.

9to5 Recommends

To employers

- Equipment should be ergonomically designed; that is, it should be adjustable to the worker, *not* vice versa. The angle of the keyboard to the screen should be easily adjustable. Both the brightness of the letters and the contrast between the letters and the screen should be adjustable as well.
- Display screens with glare-reducing glass are preferable. Printers should be as quiet as possible and not placed near the operator. Optional antiglare shields and noise covers should be purchased and installed for all operators.
- Comfortable, adjustable chairs are essential for VDT operators.
- Frequent rest breaks are essential and should be provided as recommended by the National Institute for Occupational Safety and Health.*
- Regular employer-paid eye exams should be provided for all operators, and employers should pay for special eyeglasses, if needed for VDT work.
- Office workers should be informed of company plans to introduce automation before decisions are made. Employees should be involved in making decisions about the applications of the equipment and the systems introduced.
- Women who choose to become pregnant should be given the choice to transfer to non-VDT work at no loss in pay.
- Preventive maintenance checks should be provided for all equipment at 6-month intervals, and workers should have access to maintenance logs.
- The VDT work environment should be redesigned to prevent crowding and noise and to provide proper lighting, adequate work space, comfortable furnishings, and good air quality.

To manufacturers

- All quality and safety features shown here should be *standard* for all equipment.
- Computer manufacturers should be responsible for training sales and other staff and for informing purchasers of word-processing equipment about proper placement, lighting, work area redesign, maximum daily use, rest breaks and maintenance, and monitoring of equipment.
- Manufacturers must make high-quality, safe equipment that minimizes the risk of exposure to low-level radiation and that provides flexibility for the operator's comfort.
- Manufacturers should upgrade low-quality equipment and should remove unsafe models of VDTs and other word-processing equipment from the market.

To public officials

- Federal, state, and local governments should use their purchasing and legislative power to ensure the quality and safety of equipment for public employees.
- Government agencies should conduct studies to determine (1) whether pregnant women working at display screens are especially at risk for developing health problems and (2) whether potential long-term risks are related to low-level radiation emissions from cathode ray tubes.

*See "General Recommendations," NIOSH Research Report, Potential Health Hazards of Video Display Terminals, DHHS (NIOSH) #81-129, June 1981. Single copies are available free of charge while supplies last from Publications Dissemination, DHHS, 4676 Columbia Parkway, Cincinnati, OH 45226.

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9to5, National Association of Working Women, 1224 Huron Rd., Cleveland, OH 44115. $5.00 for institutions, $1.50 for individuals.

Mr. **Gore**. Thank you very much.

Let me ask a few brief questions before turning to my colleagues.

I would like to note that we have gone with this panel from the short-term perspective that we began with, the 6-month projection into the future, to a very long-term perspective. Necessarily, in addressing the long-term view, you encounter widely differing projections.

I would like to ask you if we can agree on some basics. First of all, we are, are we not, in a period of revolutionary change that is virtually without precedent in its scope and pace? Does anyone disagree with that?

[No response.]

Mr. **Gore**. Does anyone disagree with Mr. Shaiken's corollary to that first statement that the specific technologies now being introduced have an unprecedented potential for displacing jobs? Does anyone disagree with that?

[No response.]

Mr. **Gore**. All right. What are the areas that are most likely to be affected? That is where we get disagreement.

Mr. Strassmann, you seem to say that information-handling jobs are going to be the wave of the future, or at least they are going to offer the most potential for new employment. That is a brutal paraphrase, I am sure.

I want to put that in contrast to the capabilities of new technology, like computers, like the Lexitron machines that Mr. Cetron talked about, to handle information more efficiently without people.

Isn't it likely, Mr. Strassmann, that some of the most dramatic job displacement is likely to occur precisely in the information-handling sectors of the economy?

First of all, maybe this is unfair, but let me ask if there is any other member of the panel who agrees with the statement I made, and then ask you to respond. Does anybody agree with that?

Mr. **Skeen**. Would you restate the statement?

Mr. **Gore**. The jobs Mr. Strassmann points to in the information-handling sector of the economy may be more likely than others to suffer the impact of new technology, specifically computers, typewriters that you can talk to, and, in essence, a combination Dictograph and typewriter.

Mr. Cetron.

Mr. **Cetron**. Yes, I think that I would agree with what Paul was saying, that the information area is going to explode, and I really mean that. However, I believe it will not be for programers. I think programers are going to be displaced because you can talk to the machine and it will do it for you beautifully. I think you need systems analysts and you need people to work in the background to make sure you can pick up the differentiation there for artificial intelligence. You need computer technicians. You need computer software writers. You need people to work in computerized graphics. You need people to work in computerized design, even people working in music to help you with synthesized music, et cetera.

What I am saying is that I believe the information area will grow. It will probably grow 44 percent by the year 2000 in accounting, which is a major area. However, I do not think the things we are talking about in programming per se will be the area it is going to go into. I think it is going to be in the ancillaries on the outside of that.

Mr. **Shaiken**. Mr. Chairman, I would agree with the thrust of what you said. I think that there are, in fact, real employment dangers here because the barriers in terms of replacement, the barriers to diffusion, in very many cases are not technological. They are economic or, to the extent that they are technological, it is as regards an infrastructure to implement these technologies. That does not mean that all jobs will be eliminated. Entire new industries will grow up that we cannot even foresee today. However, that does not change the fact that what I think you are saying is essentially correct. We have a technology that, if it is applicable anywhere, it will be in the area of information processing, and that could skew the area of the question of employment in ways which we cannot perceive very clearly now. Because that is a possibility, I think it is something we have to take quite seriously.

Mr. **Gore**. Mr. Strassmann.

Mr. **Strassmann**. Mr. Chairman, I believe that when I discussed my slide on page 3, I accentuated the positive. I was pointing out that what we need to do is to create information workers who are productive. If we create and harness our information workers so that they contribute to the growth of output—and I projected a target, a potential target, for this country of more than $25,000 of income per capita—in fact, we are going to have a labor shortage. That is the scenario that I was outlining.

I think I was with Mr. Skeen on the theme of productivity as the agenda item that we ought to talk about.

I also pointed out that in the event we do not have productivity, automation will create unemployment. That is a scenario that I do not like to dwell on because it is not very constructive or very positive.

Mr. **Skeen**. Would the chairman yield?

Mr. **Gore**. Yes. I would be glad to yield.

Mr. **Skeen**. I think that this is an extremely interesting discussion. I think one thing we are assuming here is that job displacement equates to residual unemployment. I do not think that is what we are saying.

Mr. **Strassmann**. No, absolutely not. Absolutely not.

Mr. **Skeen**. Maybe an assumption that we should clarify is that that is not what we are talking about.

Mr. **Strassmann**. Correct.

Mr. **Cetron**. It has the potential.

Mr. **Skeen**. Oh, absolutely.

Mr. **Cetron**. I think, Mr. Chairman, that is what you were trying to bring out.

Mr. **Gore**. The whole purpose of the 2-day hearing is that we must avoid that connection. We must make certain that job displacement does not equal residual unemployment by (a) getting a much more accurate picture of the trends now developing, recognizing that it is virtually impossible to predict with a high degree of accuracy what is going to occur, but recognizing also that we can do a much better job than we are now doing and (b) making greater efforts to match retraining programs to the more accurate picture that we hope to develop.

Mr. SKEEN. Mr. Chairman, I think you are exactly right. However, the thing, too, that we are saying here now is that this change has been so rapid that the mandates we have given our informational gathering groups is so out of date and so useless, and the mandate itself is almost useless, and what are we going to do about it?

Mr. CETRON. I have a comment which I think would be important here. That is the difference between a futurist and a forecaster. I am not a futurist, by the way; I am a forecaster, and there is a difference.

If you look at energy, for instance, a futurist would say, "I want solar energy. It is clean. It is inexhaustible. There is no radioactivity. That is the way we have to go."

As a forecaster, there are three things you have to go through, and let's get it back to this particular area here. It must be technologically feasible. It has to be economically feasible or cost effective. It has to be socially and politically acceptable. Solar energy does not meet the second requirement.

Let's take that back to the job area. There is no question a lot of the computerization work we are talking about is definitely technically feasible. Economically feasible? Yes, the corporations could make a bundle of money if they were not being socially and politically acceptable, doing what is required for everybody. Therefore, the tradeoff that Mr. Shaiken was talking about is here. You have to say, "How do I make that tradeoff and take care of the people who are going to lose those jobs? Do we reduce the number of hours for everybody and still produce more and do better there? Do we have some other way of making sure that everybody ought to have the opportunity to work, as Congressman Wright brought out? But the question is, how do you make it attractive enough for the corporation to invest in new equipment and still get themselves a percentage increase in their profit, because capital formation has to be taken care of?

Mr. GORE. Certainly, there is not likely to be any shortage of things that need to be done, but there may be a wrenching social cost to figuring out how to compensate people for those things that need to be done and how to match their skill acquisition path with the skills that are going to be in demand.

Mrs. SCHNEIDER. Would the chairman yield for a moment, please?

Mr. GORE. I will be glad to yield.

Mrs. SCHNEIDER. I regret that I have another appointment and will have to leave the hearing. I would like to take this opportunity to thank the chairman for these hearings and congratulate the witnesses on this panel for excellent testimony.

Mr. GORE. Thank you very much.

Mr. GORE. Mr. Skeen.

Mr. SKEEN. Thank you, Mr. Chairman.

I just want to say that this has been an extremely illuminating panel. The discussion I think is appropriate. The base line is whether we as a government are doing anything helpful in the area of labor statistics or are we as antiquated as some of our technology has become.

Listening to the panel this morning—beginning with the very specific employment needs of clericals—every dissertation was a different perspective, yet there was an amazing amount of common agreement of where we are going and what the problem is.

I think I can see where the Department of Labor is having a problem with some of the mandates that the majority leader read this morning from the statute. First of all, every one of these mandates requires some kind of appropriation, money. Then if you do appropriate money, what do you do with it and how effective is the thing?

Absolutely nothing has been done since 1978. Maybe that is a godsend, but I would like to hear from some of you.

What do you suggest to make the Department of Labor more effective? Your testimony this morning I think overwhelms us with the fact that there is such a gap between what we call unemployment today and what it used to be.

We know that we have people commuting thousands of miles on a work basis right now. Airline captains will live in New Mexico and make a run from New York to Puerto Rico on a regular basis. They commute. They have been doing that for years. It is a change.

We talk about displacement. That is very difficult. My colleague down there mentioned earlier, how do you tell a 52-year-old automobile worker that he is going to have to pick up and go? Well, you don't. Somewhere along the line we as a government ought to be more helpful.

I would appreciate any advice that you have to the Department of Labor about where we ought to be going with the kinds of data we collect. Is it so inadequate that maybe we shouldn't be trying to base predictions on it? Is there a better and more immediate way that we can collect and apply this information? Is it available? Can it be made more helpful to people in the employment sector, particularly those looking for jobs?

Mr. Cetron.

Mr. **Cetron**. I have a couple of comments.

First of all, I think part of the problem is that, as was brought out earlier, they do not have adequate funds in some of the areas. More importantly, I think they are looking in the wrong places. I think they have to get closer to the jobs that are going to be in the future, based on what technology will provide.

For a quick fix, and we need a quick fix, we have to get people off unemployment and back to filling potholes, and that is an important quick fix. That is not a long-term solution at all because at the end of the year and a half or—pardon me—at the end of the 1984 election they will not have jobs any more. We are talking about getting something to give them jobs that are going to last for a longer period of time, and I think that means that you have to take these people who are unemployed right now—automobile workers, steelworkers, et cetera. I think we have to use the computer to train them for the jobs we know are being advertised all the time in all the newspapers. They are basically technician jobs and are fairly high tech. That is why I mentioned this business of the computer being used, as a training tool. It is private. You do not have to go back and compete with the young kids. You are in your own little stall, and you can go at your own speed. You can get the information back immediately in the positive and the negative. You get trained in a shorter period of time, when you are not competing with the younger fellows out there who may have more experience at Atari and the computer games. That is one thing I think we ought to do as a quick fix.

I really think that the new administration's program on job training is an excellent one. It says let's not spend 60 percent of the money for administrators; let's spend 15 percent on administrators. Let's spend 15 percent on the basis of getting people to minimum educational standards, and let's spend 70 percent of the money on training. Let's give it to private industry.

In this case it is much more difficult for a private firm to fire somebody than it is for someone outside to train them and say, "Now why don't you hire them?" That is more difficult to do. I think some of the things they are doing make a lot of sense. What we have to do is get a group in the Department of Labor Statistics specifically to say, "What do we take a look at in what technology can provide?"

You are going to hear another witness, Clyde Helms, who is going to be talking about occupational forecasting. What are the new jobs? How do we train these people? How do we get out to the PIC's, the private industry councils, in all the States and say, "Hey, here's what is available. What people do you have in here that can fit these needs," and get them trained as quickly as possible. That makes more sense to me.

Mr. **Skeen**. Mr. Strassmann.

Mr. **Strassmann**. I was very pleased that Judy Gregory mentioned the employment study in Austria. I am intimately acquainted with that study. It is a study that could be done very rapidly, at a very low cost for the United States.

I was heading a panel in 1963 that recommended that kind of an input-output model of the economy. It was recommended to the then Secretary of Commerce, Mr. Luther Hodges, and he accepted that. However, nothing happened afterward.

If there is one No. 1 priority, Mr. Skeen, that would perhaps help this committee more than anything else I know as rapidly as possible, at the lowest cost, it would be to employ the resources of Professor Leontieff, the father of the input-output table, and do that for the various employment sectors of the U.S. economy.

Mr. **Cetron**. Wes' contact really is in R&D and it is across the whole board, Wesley Antoffe. He got the Nobel Prize for that.

You have something else that Wes needs before he can start an input-output model. He has to know—if you are going to take the old jobs and do the same thing, you are going to get a break out and say, "Gee, how wonderfully well they did." You are going to use the old jobs. That is what Wes would be using in most cases.

What you have to get to is, what are the new jobs going to be? We are doing a study now for some firms on taking a look at what are the jobs we have and the new ones; how many jobs are going to be required in the future; starting salaries; midcareer salaries; can you work in the office, at home, or in the factory; are the jobs going to be obsolete, slow growth, medium growth, high growth, fiercely competitive or brandnew ones; and how much training do you require? Is it vocational education in a high school? Is it a 3-month program? Is it vocational education? Is it an apprentice program? Is it on-the-job training? Is it 2 years of college or 4 years of college? You have to break that down.

Then I would recommend that you do as Paul said, go back and get someone like Wesley Antoffe or Clop or Elman at the University of Maryland for the same thing on a more detailed breakout and say, "What does it do to these jobs if you have the new ones?" To start with the old stuff, it is going to be more of the same.

Mr. **Shaiken**. Mr. Chairman, I think we are confusing two issues here. One is the question of the number of jobs that are going to be out there, and the other is the issue of retraining. They are somewhat distinct.

In terms of the number of jobs that are out there, if this were 1966 right now, I think we would be justified in saying, "What do the employment projections look like?" However, the unemployment problem is already here, not for technological reasons, but it is something that is a reality for over 11 million people. The key question in terms of the number of jobs is, what is the role of technology going to be in terms of this recovery? Will technology be the job creator in this recovery? Or will it build in market-caused unemployment? Will it convert that to technological unemployment?

Also, in terms of training, I think we are confusing training with skill acquisition. Now skill acquisition is a key part of training but, as the Congressman from the Midwest brought up earlier, if you are a 52-year-old auto worker in Detroit, you were taught the American dream when things were well, which was to own your own home. Fifty-five percent of the people in Detroit own their own homes. It is not enough merely to say you have learned a new skill. There has to be some infrastructure that allows the individual to get from an area of despair to an area of opportunity.

I think we also have to, as complex and as difficult as this might be, go beyond merely looking at what happens to the individual. It would not be enough for us as a society if we could resettle all the retrained people from Detroit to Houston. What we then have left are those people who are least unemployable in places like Detroit with an infrastructure which is no longer self-sustaining.

The issue of training really has to be in this more comprehensive framework not only of how skills are acquired, but of how the transition is made.

One important item in this area I would like to throw out is the concept of pretraining rather than retraining; that is, rather than merely focusing our energies on those people who already are unemployed, although that is obviously the priority, we can see quite clearly what some of the technological trends are looking like in a wide variety of industries.

As some experience in West Germany has shown, the most effective kind of training occurs while people are still employed, so that the transition does not have to occur after someone has suffered under the worst of circumstances. I think the whole concept of pretraining is something that may be worth looking into.

Ms. **Gregory**. I would like to make some comments from the perspective again of our constituency, women clericals. There are approximately 18 million clerical workers in the work force today. It is nearly one in five of U.S. workers. It is the largest single group.

The predictions are that that work force will grow to 22 million clerical jobs by 1990, and 80 percent of those jobs today, and most likely tomorrow, are occupied by women. In addition, it is the area of employment for 35 percent of women.

When we talk about new and emerging occupations, it makes sense also to think about this vast area that is going to continue to be the area of employment for many, many millions of women.

A second point is that in the BLS data that we do have there is at least one identifiable vulnerable group, and that is key punching operators, of which there are somewhat more than a quarter million. It is a stagnant or declining occupation. That is more a question of how rapidly companies can afford to change over that work to electronic key entry, and so on.

The women in those jobs—it is 95 percent women, approximately 20 percent minority women, higher than average. The average age is older. The average job tenure is longer. An educational effort can be made to particularly reach those workers, and that is a large pool of workers who are vulnerable.

I think that it is important as a mandate to the Department of Labor to look for what are the other clerical occupations, currently employed workers who are vulnerable in that way.

As a third point, we believe that the Congress should adopt and guarantee a set of rights to workers, one of those being the right to advance information from their employer about technological changes which are going to occur. I will give you an anecdote that illustrates this.

The medical officer for a west coast bank, one of the biggest banks in the country, told me in a workshop on job stress that he knew that hundreds of workers in that bank are going to be laid off in the next 2 to 3 years because of the automation plan. He suggested to the highest levels of the bank that they should inform those workers, so that they could begin to plan to find new jobs or, in his words, "they should inform the workers because this is going to cause a lot of stress." However, the top management would not allow him to inform them.

I asked him why the management would not allow him, the medical officer, to carry out a policy of informing the workers, and the response was "because then they would look for other jobs." Now that is exactly what those workers should begin doing.

That is one example I know of. There are many more.

I think that the right of workers to know what is ahead of them within their company gives them the leadtime. Companies plan in advance and can give their employees the leadtime to begin to seek training and to find out what new openings there are going to be. Yet, because there are so few unionized clerical and office workplaces, that very rarely occurs. For that reason, we think that should be a guaranteed right to U.S. workers.

Mr. SKEEN. I think Dr. Cetron has something to say.

Mr. CETRON. Yes. I have a major problem with part of it, and I will tell you what it is. It affects Detroit specifically and the automobile industry.

If we go back and take a look at what the automobile is today and we start training people for the new jobs in robotics in that area, specifically automobiles, we are going to make a major change. By 1987, 50 percent of the car by weight will be plastic. In 1991, 92 percent of the car by weight will be plastic. This makes a major shift. A car lasts 22 years, roughly. You have a whole shift in propulsion plants, internal combustion engines, fuel cells or batteries. The people in the tech centers know this. They are working on it.

Here we are considering what we are going to do with the redesigns. We are still talking in terms of metal. That is why I think the business about making up a list for Antoffe and an input-output analysis of what is going to happen—it has to be for the new things that are coming down the stream, not the old stuff. Every appliance is going that way too.

In addition to this, one of the problems you run into is training. It is a major one. You tell the schools, "Go get yourself new computers for training people in vocational education." Let's not train welders any more; robots will do it better. Let's not train a machinist any more; we can get better outside, or a paint sprayer. They say, "We can't afford to buy the equipment," such as the interactive computer. The truth is they cannot afford not to. The vocational education department ought to have that computer working from 8 to 4 for the schools, from 4 o'clock until midnight for those people who are unemployed now and can go back and get training on their own, having this underwritten by the school and by the local people; and in the evening, from 12 o'clock to 8, if they know people are going to be laid off in their own corporation, let them go on the midnight shift to be paid for by the company. The equipment is being used around the clock. Have them all defray the expenses. Lots of things can be done if we try to be innovative in this thing. Nothing is being done at the present—correction, very little. I will not say nothing. Very little is being done in that particular area right now.

Mr. GORE. Congressman Durbin.

Mr. DURBIN. Thank you very much.

Mr. Cetron, I would like to ask you to assume a new role for me for a moment. Take the job for the next few moments of being Secretary of Education. I know it is a tenuous position in this administration, but I would like to offer it to you for a few minutes. I would like you to devise for me the curriculum you would suggest that high school students in America take as a basic core curriculum that they would need to be trained in for tomorrow's jobs. How would it change from what we know historically?

Mr. CETRON. First, there are things we have now I think that are important. I might well suggest that we start from the beginning at 5 years old instead of starting at 6. I might well say from the very beginning, from your first grade on—in fact, Carnegie Mellon has a program now that they start kids at 2 and 3 years old. I said, "Well, what do you use for a beginning when they are going to start in computers?" He said, "They ought to be toilet trained and can walk." They cannot even print, but they can punch out the information.

They walk in. They pick out their own name, punch it in, and the machine says, "Good morning, John. How are you?" He looks up and there is a little picture up there. If it is smiling, he punches in "F-I-N-E;" if it is not, if it is a mouth going down, he says, "Bad." It says, "Gee, I'm sorry you're feeling bad today."

I am saying it is one on one. They start when they are very young. I think there is no reason for not starting at 5.

We do not need 3 months off for summer. We do not go out and harvest any more. Less than 4 percent of our population is out there doing that. Vacations could be cut down, so that more could be put into the curriculum.

I think computers should start earlier. They ought to get more basics in math, physics, chemistry. This is going to sound crazy, but I think we ought to go back to some foreign language as well. I do not think anything is wrong with learning a foreign language.

Mr. DURBIN. It does not sound crazy to me.

Mr. CETRON. I am saying we have gotten away from all of this. The sixties was a specific area. "Everything I do, I am entitled to get an education." Even the president of Harvard went out and picked up garbage for a summer. I do not think that is an educational thing. Sure, it is fine if he wants to get an impression of what is going on, but I believe very seriously that we ought to be getting back toward an area of saying education is necessary but it is not sufficient. You have to be computer literate, and you also have to be trained.

If you want to be an artist or you want to be an actor or an actress, that is great, go for it, but get yourself some training to get a job on the side where you can make enough money in the interim.

I think we ought to get back to basics, and I think we ought to take some of the stuff out of the schools, not dump more back into the schools. I think sex education may be important, but to be a disciplinarian at school and start going back to prayers in school—they have enough job just educating the kids, and they cannot get it through.

I think we have another problem as well in the educational system. I think we ought to make a very major area in trying to get better teachers in the school system now by increasing the salaries that are required there, by increasing the capability.

Now a quick fix, very simply—and industry can do this, too—if you need math, physics, chemistry, and science teachers and you cannot get them, and in most places you cannot, anybody who is retired right now, you ought to give them a 2- or 3-month course and let them get back in and start teaching math, physics, chemistry, and science.

In addition to this—and I know the teachers' union is not going to like that, and I apologize, but I think it is required for a quick fix.

I think we ought to start getting better utilization, if you will, of some of the programs such as Sesame Street and the Electric Company. These things do a hell of a job for the kids, and they bring them up quickly.

I have used them overseas in Indonesia, Brazil, and Kenya. I have used them to teach English by using some of these things. They work.

The teachers have to look at the computer and video tapes specifically as being an adjunct to help them, not something that is going to take away their jobs from them.

I see it as a different approach. If I were in education, I would make a major push to change it and get more responsive education.

Mr. **Durbin**. But most of us were raised under reading, writing, arithmetic, and basic skills we would learn to graduate and be literate. I have often wondered why we are not talking about basic keyboard skills, typing skills, as being essential from the beginning.

Mr. **Cetron**. I agree with you.

Mr. **Durbin**. I never learned how to type. They told me mechanical drawing would be much more useful for me later in life. I wish I had that to do all over again.

Mr. **Cetron**. You are preaching to the choir. I agree a hundred percent.

Mr. **Durbin**. Let me ask you about one other element. You bring it up. You mentioned prayer in school. Regardless of anybody's position on that issue, I think we have to face the fact—and I think if I have to plug a book, Mr. Nayes, but in his most recent book he has indicated something that I think is very factual. As we start talking about more and more machines and more technical approaches here, we get this real yearning in that American spirit that says what about those basic fundamentals and values and the spiritual needs, the high-tech, high-touch, as he says it. It seems to me that there is a demand in this culture, in this society, that we supplement what we are teaching in terms of technical skills with some very fundamental values. Is that out of the school?

Mr. **Cetron**. No. I think it is absolutely required, but what says we can't get education at home? If someone wants to go for religious education, let them go an hour after school.

I also think that we have a major problem coming out of the administration now where it says we ought to give tax credits for those people who are sending people to private schools. If we do, we are going to end up like Britain with a two-tier system in education. It is wrong.

Mr. **Gore**. The first person who brings abortion into this mix, I am going to bang the gavel. [Laughter.]

Mr. **Cetron**. I think we need to get back to basics and the attitude, very simply, if we are talking about living a lot longer—and because of what is happening in sciences, we are going to live a lot longer—it may well be that some of the tenets we had before may not be exactly the same. However, I do think they have enough in educating people right now, the teachers, rather than getting themselves bogged down in everything else. I just think some of the things they require are going to be more than we are teaching at the present time.

Mr. **Durbin**. Since we are treading on the controversial here for a minute, let me keep on it and not mention abortion, incidentally.

For anybody on the panel here, what role do you see in what you have described for decades to come for the labor union? What are they going to be doing? What role do they play?

Mr. Strassmann.

Mr. **Strassmann**. I had the privilege to be an advisor to the Communications Workers of America in their year-long quest to create the Committee on the Future. I specifically recommended, and I was very pleased that Glen Watts incorporated it in his final report that the union look at education and training as a bargainable issue. I believe that retraining is the major opportunity for the United States. In the same way as in the sixties we embarked to make a healthy America and we succeeded to increase the health budget of the United States from 3 percent of GNP to 10 percent of GNP, where it is today. Perhaps that is too much and preventive medicine can give us the same health cheaper.

My feeling is that today we spend about 2.5 percent of GNP for education. The sense that I have is to get America going we have to go to about 7.5 percent to 9.5 percent of GNP for training and education, and that is to be done not just by going to public schools and to high schools. The education of the future is lifetime education. Every man's job, every woman's job, should be both work and education simultaneously.

In line with the remarks I made, overhead and appropriation is not the way to fund information workers. I believe that so-called performance education delivered on the job through private initiative, through computer networks, can provide an extremely cost-effective environment where perhaps as much as 15 to 20 percent of the labor hours of our workforce in the nineties and in the 21st century will be spent in training and education.

Mr. **Gore**. Will the gentleman yield?

Mr. **Durbin**. Yes, of course.

Mr. **Gore**. Some of the witnesses tomorrow will be from Detroit and will describe the agreement they successfully bargained for providing for 5 cents an hour going into job retraining efforts. This will be Marshall Goldberg from the Ford National Development and Training Center at Ford's World Headquarters in Dearborn.

Mr. **Cetron**. I was going to mention that. There is something else, to answer your question for you, and Michigan is specifically involved.

Mr. **Durbin**. I am in Illinois.

Mr. **Cetron**. Illinois? Well, you are right next door.

If you look at the numbers specifically, 22.3 percent of the workforce in 1980 was unionized. It goes down to 17 percent. The average age, by the way, is 54 years old, the unionized worker today.

If you make an extrapolation because of right-to-work States, people moving to the Sunbelt, and so forth, you are going to less than 11 percent unionized workers, just in plain trend extrapolation by the year 2000. That means that the black community, if they voted, would have more political clout than the union. That is a major shift in information.

Mr. **Durbin**. Does anyone else have any comment?

Ms. Gregory.

Ms. **Gregory**. Just briefly, we are associated with District 9-to-5 and the Service Employees International Union. It is a separate but related organization with 9-to-5, which I work for, which is the nonunion association.

The issues of office automation and technological change are very, very important to the unions that do exist. On the office side, because of the overwhelming nature of the changes, being more than individuals can deal with, they will lead to at least a sustained level of unionization in office work, and we believe an increased level of unionization on the office side.

Paul Strassmann mentioned education and training. I want to mention briefly a project of the Service Employees International Union as an international. In the hospital sector, it has had a program in career development called the lead program. In that, through a labor-management committee, the union has worked with the management to identify jobs that will be displaced or changed through technological change and make sure that promotion happens internally to the greatest extent possible and that those programs begin to be implemented 2 years in advance rather than suddenly and abruptly. That is an important and responsible kind of an approach and something that the union has pushed the management into doing.

Second, I think that we will see unions in the United States following some of the developments of European unions, particularly involvement in systems design, no longer leaving how automation is implemented strictly in the control of management, either in terms of production levels forced on workers or in terms of objecting to intense computerized monitoring. I think that is a positive trend that I hope we will see more of, too. I think the unions will pursue.

Mr. DURBIN. Mr. Shaiken.

Mr. SHAIKEN. I would like to preface my remarks by saying that there is a tendency to speak about the impact of technological change, but with technologies as versatile and as pervasive as microelectronics and computers, I think what might be more appropriate is what type of future do we want. We have that opportunity today. We do not merely have to say, how will we be affected. We can decide how these technologies should be developed, which will lead, perhaps, to a much different kind of future than might happen if we did not make those choices explicitly.

I think it would be a mistake to assume that unions will be 11 percent of the work force by the year 2000. I think that would certainly come as news to most unions. It would be a little like taking 1931 as the point of departure to extrapolate the future of the labor movement when there was just the AFL.

High technology raises new issues for labor, and unions are increasingly becoming involved in those issues. We could, in fact, see a large amount of organization in a number of high tech industries, but one key element is, what role should people who are affected by technological change have in determining the character and direction of that change?

One small example, every year the Federal Government spends millions of dollars developing new technologies which are diffused through industry. The vehicle for this is generally the Department of Defense in programs such as ICAMP, the integrated computer-aided manufacturing program of the Air Force. Many workers are affected positively and negatively by the kinds of developments that take place, but what role do those unions or those workers have in governing how any of those decisions are made?

It is not as if it is merely a question of nothing coordinated is taking place in this area. A lot is happening, but the question is, what is happening—has that been explicitly discussed? Have the options been clearly stated? Are the social consequences of each option understood? Then in what direction do we go?

When it comes to computers, in particular, I think there is something that I would really term a computer illusion, that all our problems can somehow be solved if we become computer literate, and the earlier we do this, the better off we are. I think they are more fundamental—computer literacy is clearly important, but there are other more fundamental issues than merely when we achieve computer literacy.

Prof. Joseph Weisenbaum, of the Computer Science Department at MIT, recently stated that he could see no discernible difference in MIT students, between those who had studied computers their entire lives and those who knew how to use computers—or those who learned how to use computers once they got to MIT. That is not a scientific survey, but I think it is interesting.

Our real failure in education may not be merely not having learned how to use computers early enough. I have a 4-year-old daughter, and I can assure you that I think toilet training was more important than computer literacy. [Laughter.]

Mr. **Durbin**. I have one last comment or question here.

I listen and try to get an overview of what I hear. I detect a significant role for government in what you are suggesting. Some would suggest it should be at the State level, some at the Federal level, and yet we see a national trend with our deficits and proposition 13 and the like just the opposite mentality, particularly in education. I am wondering what it will take, short of a deeper economic crisis, to turn around the whole national attitude toward what we have to do in a national way, in a unified way in this country. I do not see it emerging yet. In fact, I see just the opposite in education. I am hoping that we do not have to go through a period of terrific displacement and pain before we come to that realization, but I see from the nods here that most of you agree that there is a significant role to be assumed by government in this process.

Mr. **Cetron**. This hearing helps. More media helps. We have done very well.

Mr. **Shaiken**. I would like to make just one comment on that. I think Government already has a significant role, but it is diffused throughout various agencies, and it appears as if there is no role. I think part of a significant role is defining what role is actually taking place and whether those decisions are the correct ones.

Thank you.

Mr. **Durbin**. Thank you.

Mr. **Gore**. Mr. Reid.

Mr. **Reid**. Mr. Chairman, I appreciate and would like to publicly commend you and Mr. Skeen, and especially the staff, the majority, and the minority, for these hearings. I agree with Mr. Cetron in that I think this is a step in the right direction to bring public awareness to the fore in this very critical area.

I do have some questions, however.

First of all, one of the things that we have not talked about very much is the role of people to tell young people what they should be doing; counselors, both in high school and college. I remember when I was the lieutenant governor, a father came to me just underwhelmed, I guess. He had spent—he was an insurance adjuster, and he had spent all the money that he did not have to educate his son. His son was a B+ student in something called range management or something like that. He got the degree from Utah State. He sent him from Las Vegas up there to go to school. The kid could not find a job. Now, I really tried hard. Senator Cannon, who was a friend of mine—we worked. We could not find him a job. He is now working up at the Nevada test site in something that he could have started 5 years before, and not have gone to school.

What are we going to do to get counselors to be aware of what is available? I read this article that you and O'Toole wrote. There you discuss the problems with organized labor, as you saw them. What about some of the professions—doctors, lawyers, accountants? I am just rambling on, and maybe you can ramble on with some answers. Teachers—I have heard you say a couple times today that what we need is to have teachers make 20 percent more. We all agree, but where are we going to get the money? We have school districts laying teachers off.

What about law enforcement, fire, some of the municipal-type jobs?

One of the things I am particularly interested in—and I come from a leisure-time industry-oriented society, namely, Las Vegas, Nev. You have indicated that you see the day when people will start working less, and I have heard a number of you say that. What does this do for creating more work for people to make things more pleasant for people when they have more leisure time?

Then, again, Mr. Durbin and Mr. Skeen both asked the question, what should Government be doing? We all agree that they should be doing something, but what?

Mr. CETRON. Let me answer. You asked about many points, but I will try to take one at a time.

First of all——

Mr. REID. Dr. Cetron, what you have to learn around here is that we only get one chance to ask questions, so we ask as many as we can.

Mr. CETRON. We had a book, the one you are quoting from, which came from Tom O'Toole and myself. Tom works for the Washington Post. We wrote three chapters specifically on jobs. The one on robotics was for General Motors and for the National Science Foundation, looking at the social implications of robots, by the way.

Mr. REID. I would add that with regard to robotics, the administration has recommended wiping out the program at the Bureau of Standards.

Mr. CETEON. You know, if you want to make believe that the king is all dressed, fine, but he is undressed.

The answer is robots are here to stay. Whether you like it or not, they are going to be here. We had better make sure our kids understand what they will do, what they will not do, where they will be working, where they will not be working, in hazardous areas, and that is just one example, and the social implications of them are major. We covered that in the book, "Encounters with the Future."

The second thing is we made available, we thought, in each one of these cases studies for corporations and governments and foreign governments, seven of them. That information was made available to the public, saying here are 160 jobs. Here is how many are required.

You mentioned doctors. We will probably need roughly the same number of doctors, but we will need a tremendous number of paramedics, emergency medical technicians, people, midwives who can go out there and use medical diagnostics via the interactive system on your cable at home to get information. We do not have enough of those. We have more than enough lawyers.

What we did locally at George Mason here was a shame. If we want to be a high tech society over here, they open up in Falls Church a law school, which we did not need, and they did not open up an engineering school. Virginia has one engineering school. It is down near Roanoke. It is VPI. For a high tech society, that is a mistake.

If we are talking about various types of jobs, we went through ones that will grow and not grow. You are right, you picked out the highest growth—well, the fourth highest growth industry. After genetic engineering, robotics and microchips and microminiaturization across the board, your next highest growth industry is recreation and leisure. A lot of people will be in situations of buying homes, little A-frames, moving them by dirigibles in the 1990's—against the ski slopes, the water, up where they can go do their own thing. There will be a lot of real estate people, cooks. We need tremendous numbers of people in various areas, not just high tech. You need high tech people as well to produce more of the goods. It is across the board.

It is a re-education process. The average American has a 2-week memory. I think we learned that with Sputnik. We are beginning to learn it again. The educational system does not have enough money, but you do not forget to pay your medical insurance, because you may get sick. We can't be in a position of saying, "It is your kid; not mine." We all have to pick up the tune to pay these teachers more, and get better qualified teachers in there to make sure we are going to get a better product out.

We are spending a lot of money to increase the SAT scores of the bottom 10th of the population, and we should. We are spending a lot of money, and we are increasing the middle of the population, and it is great. We are not spending the money for the brightest of our people, and we say, "Don't worry. They'll get a job, anyhow." It only takes a couple of those really bright ones to make many jobs for everybody, and we are not educating them adequately at all. That is one problem we do have.

I know it smacks of trackism and segregation. I do not care what it smacks of. I look at it from the results. We do need more money being put into the education of the brighter kids.

Maybe the American dream of saying everybody has to go to college—maybe it should not be the American dream. Maybe what they ought to be saying is when you graduate from high school, if you can get a good technician's training in 3 or 4 months, 2 years, and you can make out well, maybe that is more important in the long run. I do not know. That is not my job to make that kind of decision.

However, I do know that we have to spend more money on education. It is crucial. We are not doing it today.

Mr. **Reid**. Could I have the panel respond to the question I asked about counseling? Who do we get to advise young men and women what they should be doing? Why should this man have gone to become a range management expert, or whatever? It took him 5 years.

Mr. **Strassmann**. When you look at the role of management—and I think government and the Congress are really the supreme management of the society—there is a responsibility for looking ahead and interpreting to the society what are the challenges and opportunities.

I think the whole area of foresight, that Mr. Gore has been involved in, is an area which could provide a tremendous service. One of the reasons, for instance, for the model of Dr. Leontieff—one of the reasons I recommended, and I chaired the panel in 1964 to recommend the input-output table for the United States, because I felt that investments were being made in whole sectors of industry with a lack of understanding of what were the long-term economic tradeoffs. We have just finished in the United States a huge expansion cycle, for instance, for petrochemicals without a total understanding that the Arab nations were building petrochemical construction capacity that can deliver polyethylene at about 15 percent of our cost base. There are billions and billions of dollars down the drain.

To come back to your question, Mr. Reid, I believe that the whole role of foresight, the structuring of scenarios for the society that we would want to be, that we aspire to be, and then perhaps achieve that, is really my view of the role of the government.

It does not cost much money. You do not need a big budget. It is a role that you cannot get away from. Certainly, I applaud Mr. Gore for holding these hearings, because this is precisely the kind of dialog that is necessary to construct what I consider a scenario for an America where everybody has twice the income of today and where we are just looking for workers and offering them jobs because we are so woefully short to support that kind of an economy. That is the scenario I would like to see—how realistic it is, how we can construct it.

I believe we can achieve it, but we have to construct that scenario. We have to agree that that is the direction, this is the way we are going to make a living in the 21st century in a world where others can make steel cheaper than we can, and in a world where they can make polyethylene cheaper. We need a scenario that identifies things we are good at, and the things for which that we are going to train our children, so that they can grow up and contribute to our economy as the lead economy in the world.

I think that is the responsibility of Government.

Mr. **Reid**. Thank you, Mr. Chairman.

Mr. **Gore**. Thank you.

We have spent a long time with this panel.

Let me note one trend, and then we will move onto the next panel.

I recently found out about a project to transfer America's legal precedence onto computer tape. It is one example of many projects that involve the transfer of information stored on ink and paper into the form of electromagnetic digital impulses that can be manipulated in computers. Those tasks are likely to provide lots of the new jobs in the information field, for example, some of them.

This project by Westlaw, if my information is correct, is being carried out in South Korea. They are hiring two women for each law book and having them input the data. In many cases they do not even read English. Then a computer program automatically matches any differences between the two input streams and highlights them, and someone who does read English comes and checks it and corrects it. The end result is error-free computer tapes. The end result is then transmitted by satellite to the United States in less than a second.

If this is a trend, then some of these exciting new information jobs may not be in the United States at all.

Would any of you care to comment on the implications of the example?

Mr. Shaiken.

Mr. SHAIKEN. Yes. I think it is very clearly a trend, because the technology is fully in place to do that. This technology really eliminates the constraints of time and geography from virtually any process. Whether it is entering legal books in Korea, or doing virtually any kind of data entry operation anywhere in the world, where the rates are lowest and the conditions are most favorable to the firm involved, the technology is in place to do that, and we are seeing that take place in such a wide variety of industries that I think it could be one of the most important, yet hidden, trends that we are facing today.

I think this brings up something that Ms. Gregory raised earlier, which is the whole question of how people, how workers, are going to be affected by these changes, in terms of advance notification.

For several years we have pointed to Atari as really the example of what we as a society knew how to do best, our competitive hope. According to Business Week, the first 600 of the 1,700 workers who will lose their jobs as a result of production transfer to the Far East, the first 600 workers received 1-day notice. We do not know what training they had going into those jobs. We do not know how long they were there. We do not know what their relation to the company was. However, if Business Week is correct, we know that all of that terminated in a day.

Now, if that is what workers can expect as a result of something—in this case, the transfer of production, but in other cases there is the clear example when technology comes in and people go out in a similar way—I think that infrastructure for how people are treated in relation to this change and the kind of notification and the kind of control they have over their own lives, will be the ultimate determinate, not only as to how they relate to the technology, but to how these technologies are used.

The most automatic of these technologies still requires critical human inputs. If people are threatened by the technology taking their jobs, I think those inputs will suffer accordingly.

To the extent that all of this can be decentralized, not just in terms of data entry, but in terms of manufacturing itself, we are looking toward the link between competitive well being and the creation of employment being severed. A company can do very well competitively in the international market, and it can be a U.S.

company without creating any jobs in the United States. I think that raises some very troubling issues.

Mr. **Gore**. Mr. Cetron.

Mr. **Cetron**. There are three words that can summarize the whole thing. Corporations know it. It is called: Automate, integrate, or evaporate.

Mr. **Gore**. Mr. Strassmann.

Mr. **Strassmann**. Respectfully, I want to object to this. I think we are losing sight of the fact that if you have an economy where the average income per capita is $10,000, and we are roughly that kind of economy, it means $5 an hour wages.

The particular Korean keypunching job, with which I happen to be acquainted, pays 65 cents an hour. We might as well recognize that in a prosperous economy we will not be able to sustain 65-cents-an-hour jobs. We have to find jobs which pay at least $5 an hour and, if my scenario is correct, which is $25,000 to $30,000 income per capita per year, we have to find jobs for America that earn, through value added, approximately $15 to $18 an hour.

How do you create that? It just happens that a Xerox subsidiary by the name of Kurzweil has produced a machine that eliminates keypunching. It scans the text, including legal text, by the way. It can scan newspapers and telephone directories.

We have expanded the payroll of that group now by 100 percent every year because, as electronics pervade, more and more of these jobs get created. However, what we are making possible now, by paying people $20 an hour, we are now able to create in the United States jobs called data base management jobs. We are going to expand the data base information industry because we have now provided a low-cost base, a means of creating value added.

There are two ways of looking at the future of America. One is that we have peaked our output, our production, and, therefore, we are just going to slice up the pie. Therefore, we need all kinds of workers' councils to review, approve, counsel on any automation. That is certainly the direction which some of our European allies are taking.

I believe that we ought to take a much more positive view. We ought to agree that we do not want to maintain 65-cent-a-hour jobs in America, and we are going to leverage our future by creating $15-an-hour jobs.

Ms. **Gregory**. But there is an alternative to shipping those jobs out of the country. You can redesign those jobs. This is a highly versatile, highly flexible technology. Rather than shift the worse jobs offshore, there is the potential to redesign work within companies to do what you are saying. I think that is the gist and that is the focus that should be taken.

I want to mention, also, that what is called the offshore office that you are describing is just one of several problematic trends that are related to centralization and increased mobility of office work, another one being suburbanization of office work, something that is going to mean that central city employment in office areas can suffer in parallel ways to what has happened with manufacturing jobs and can mean that a tendency has been noted in a new study that is in progress for companies to deliberately seek second earners, women who are second earners, who are less likely to unionize, who are less likely to need full-time jobs, who are less likely to demand higher pay, rather than keep those jobs in the central city where they are dealing with single heads of households or primary earners who are the most in need of full employment.

A third aspect is that of office homework, which is often touted as an easy solution to the lack of quality child care. I think it is imperative not to see it as a substitute for quality child care and to start exploring that as a difficult and problematic trend.

Mr. **Gore**. Let me just summarize, if I might, by saying that the testimony of this panel makes it clear that this country must develop a better understanding of the critical trends that technology is forcing upon us. We must have a better match between job retraining programs and our better understanding of those skills that are going to be in demand. We must realize that while it is impossible to predict the future, it is possible to choose between alternative futures. If we are more aware of what will happen absent conscious choices, we can affect the future of this country and choose the rather optimistic scenario that Mr. Strassmann outlines for us and avoid some of the trends that lie out there threatening the job market of the future, if we do not make intelligent choices.

I would like to thank all of you on this panel for helping us get a little bit closer to that goal.

I would like to call now the next panel. We have three more witnesses, two of them on this panel.

Clyde Helms is president of Occupational Forecasting, Inc., and Brian Usilaner is Associate Director of the Accounting and Financial Management Division with the National Productivity Group of the U.S. General Accounting Office, which has just completed a study of Government efforts in this area.

Incidentally, our final witness, after this panel, is Ronald Kutscher, Assistant Commissioner of the Bureau of Labor Statistics at the U.S. Department of Labor.

Is it Usilaner?

Mr. **Usilaner**. Yes, that is close enough.

Mr. **Gore**. You are accompanied by——

Mr. **Usilaner**. Ed Fritts, who heads up our private sector productivity work at GAO, and Dave Solenberger, who has done work on labor market planning. Also, we have Morey Chick, who has done some efforts on automation and employment.

Mr. **Gore**. Welcome to all of you.

Mr. Helms, you are president of Occupational Forecasting, Inc. We welcome you here.

Without objection, the prepared text of both witnesses on this panel will be included in the record in full at the appropriate places.

We invite you to summarize, if you care to do so, because the hearing is running a little bit later than we had planned.

Mr. Helms, we will begin with you.

STATEMENT OF CLYDE W. HELMS, PRESIDENT, OCCUPATIONAL FORECASTING, INC.

Mr. **Helms**. I will try to stay within my allotted 10 or 15 minutes.

Thank you, sir.

I have looked forward for some time in hope of an opportunity to present these new concepts of occupational forecasting and the results of my studies of occupational information collected and disseminated by the Departments of Education, Labor, and Commerce.

I would like to say that much of the information in my testimony has been provided by staffs in these three Departments. I feel these civil servants realize there are problems and they want to help in improving essential services to the Nation.

I think, also, it is appropriate that this hearing should come under the purview of the Subcommittee on Investigations and Oversight.

In the history of labor and industrial changes, populations have resisted major advances in the workplace. Today the economic viability of the Nation is at stake, and a fully informed public is essential to our success in exploiting the benefits that will derive from maintaining our industrial and technological preeminence worldwide.

The fullest understanding of the unprecedented change taking place today is imperative, as this committee has recognized, if the fullest support of new programs is to be forthcoming from the people. I feel the Nation's leaders have failed to communicate adequately the great challenges now confronting us, including the needs for major changes in the roles of Federal Government organizations and long-standing statutes. It is impossible to address these adequately within the time for my introductory remarks here. My printed testimony provides extensive descriptions of these challenges and opportunities.

I would like to quote Mr. William S. Anderson, chairman of National Cash Register, who noted in an address at Notre Dame, "We have been careless caretakers of our economic system, which for many decades created more wealth for more people than any other system in history. The 'we' includes all of us—government, labor, business management, and the public at large."

The dilemma facing America today transcends the issue of meeting the Japanese industrial and technological challenge. "At stake," he said, "is the industrial supremacy which this country has enjoyed for most of this century."

My printed testimony describes longstanding failures in the systems and operations of the three Departments mentioned and presents recommendations for solutions. Their failures have contributed seriously to the declines in the American work ethic, in productivity, in the quality of our products, and in our education and training systems.

Economic penalties have been severe, including record unemployment and long-term prospects of large numbers of unemployed people whose jobs are gone forever. Today we stand with the national work force inadequately prepared to compete as successfully as we have for most of this century.

While there are jobs out there, as the President and the Secretary of the Treasury have said, the fact is the Nation's work force is obsolete and, at best, obsolescent. It is difficult for me to conceive of any present occupation that has not been affected by technology change.

We must undertake a national program to upgrade and rebuild our national work force. To meet the standards of the emerging 21st century work force, which is less than 17 years away, we must recognize that the inexorable change pressing upon us is the first wave of the 21st century work force. That work force will not be born in some Cinderella-like magic at 12:01 on January 1 in the year 2001. It is being forged today in the robotic factories and new computer-aided design systems in computer-assisted manufacturing plants and in many other industrial technologies, sciences, and arts.

Rebuilding the work force requires valid design, engineering, and construction data. What information do we have with which to rebuild the work force? The Department of Labor Dictionary of Occupational Titles is the keystone of the Nation's occupational infrastructure. It is the source of occupations listed in the Department of Labor Occupational Outlook Handbook and in the Nation's industrial apprentice programs.

It is obsolete. Our apprentice programs are obsolete. The dictionary contains 28,000 occupations. Of these, 12,000 are defined, albeit some going back to colonial yesteryear. Eight thousand additional ones are titles without definitions but which, in some mystical way, relate to the 12,000 defined occupations. The remaining 8,000 occupations are titles only.

The dictionary is republished decennially. The fourth edition is dated December 1977. More technological job displacement has occurred since that edition than in any comparable period in history. Yet, those occupations in which the jobs are gone forever remain in the dictionary and other guidance publications, and in our education and training programs.

The dictionary is the authoritative reference used by public service employment agencies and in Government programs such as CETA and its successor, the Job Training Partnership Act. It is the basis for the job bank operation specified in these statutes and for which the committee has made specific criticisms in the hearing before this point.

To what extent is the inability of employment and vocational counselors to place unemployed, experienced workers in new occupations attributable to this dictionary? How many of these 28,000 titles are obsolete? How many are current?

DOL staffs have advised me they have no directive or administrative methodology for identifying and eliminating obsolete or obsolescent occupations. There is no way for them to determine how many of these occupations are obsolete.

I have provided in my printed record testimony a set of terms used by my firm in identifying obsolete, obsolescent, current emerging and emergent occupations. These could be used initially in assessing the work force occupations of today, and those we will require in the near future.

Working with obsolete occupations is a poor way to commence building a new work force, but even if we had current and forecast occupations data, we need quantitative job demand data, too. Job forecasting is both inadequate and inaccurate.

The Occupational Outlook Handbook forecasts employment levels, numbers of jobs by occupations listed in the Dictionary of Occupational Titles. This handbook is a primary reference used by career guidance and employment counselors.

The numbers of jobs forecast are derived, in part, from the Department of Commerce Current Population Survey. These statistics are developed in monthly surveys of approximately 58,000 households located in 629 population survey units. Approximately 60 percent of these surveys are made by telephone calls: 40 percent by direct visits, usually on first contacts with the household. Potentials for serious errors in collecting these statistics are extensive and have been described in Presidential Commission reports.

Population survey unit employment and unemployment statistics are related to approximately 400 groupings of occupations, none with definitions. Attempts have been made to cross-walk (correlate) these occupational titles to the Dictionary of Occupational Titles. These statistics are factored into or used in some way by the Bureau of Labor Statistics in employment and unemployment reports to the Congress.

The difficulties and failures in correlating these occupational statistics in these systems of the Federal departments have been documented in special studies by Presidential commissions and others—some going back decades. The Department of Commerce has developed a Standard Occupational Code which relates occupations to its Standard Industrial Codes. However, staff advised me that this standard occupational code classification system does not assure validity of the occupations listed in the SOC's. The Department of Education, Office of Vocational and Adult Education, prepares and distributes vocational education data through its vocational education data system. Here, too, attempts to cross walk that occupational and educational information to the dictionary have not been successful.

The Congress directed establishment of a National Occupational Information Coordinating Committee and State Occupational Informational Coordinating Committees. As in the Department of Commerce standard occupational codes classification systems these pipelines process information of questionable validity and usefulness. I agree with some of the staff of the Department that these occupational information coordinating committees could provide useful services if current, valid occupational data were available.

At this time, however, it appears this is an area which the subcommittee should look at.

With reference to the complexes of all these systems, many advise that they cannot conceive how the Congress can rely on employment and unemployment data furnished by the Bureau of Labor Statistics. The Congress uses this information in many ways, including legislation for jobs programs, but what jobs?

Following a briefing on these occupational statistics furnished to the Congress, one of the Joint Economic Committee staff remarked to me, "Garbage in, garbage out."

I have attempted to organize and present this information to show that we do not have information on new high tech occupations, nor reliable statistics on present occupations and the full ranges of employment opportunities. It is particularly important today that this subcommittee investigate these conditions. Staffs in every State are now planning to implement the Job Training and Partnership Act. They are all aware of the critical need for current valid labor marketing information. That information does not exist for many of the new occupations.

If the States and their private industry councils set up new training and retraining programs in sunset occupations, more billions of dollars will be spent in a rerun of CETA failures. The Nation cannot afford to let this happen, either on the basis of billions of dollars wasted or the traumatic impacts upon people trained in occupations for which formerly employed experts now walk the unemployment lines.

I have debated with DOL officials the differences in job forecasting, such as in the Occupational Outlook Handbook, and the new science of occupational forecasting. In the latter activity, I identify needs in new or changing technologies and use this technical information to create new occupations.

In a seminar for approximately 10 DOL officials, and in a major conference of Federal department staffs, I was advised that DOL officials had never created a new occupation, do not know how to create new occupations, and question whether they have the authority to do this.

No one is creating and forecasting new occupations in the high technology industries.

Exhibit 2 of my written testimony lists some new occupations selected from my firm's occupations data bases. These data bases include many proposed new occupations for which we forecast potentially millions of new high tech jobs. To the best of my knowledge, Occupational Forecasting, Inc., is the only such firm in the country. Other countries have corresponded with me. It appears this is "a new science," or as some of my contemporaries would insist, "it is an art, not a science."

However, what is important here is, that if we are to rebuild the national work force, we need new "sunrise occupations" for new "sunrise industries." I urge consideration be given to establishing a national occupational assessment and forecasting project on a priority basis. Obviously, delays in implementing such a national project will take a heavy toll, beginning now with implementation of the Job Training Partnership Act.

In conferences and workshops in many cities throughout the North Central States, former CETA staffs in the cities and in governors' offices have advised me they have a great need for these new occupations. In the absence of such new occupations, they can only resort to establishing training programs to train people in the same occupations for which they established training programs under CETA.

In addition to the enclosed sample of new forecast occupations, and thousands of others that could be generated with the resources of a national project, a methodology is available to facilitate such national undertaking. The only successful experiment in the private sector to develop such new occupations was funded by the Department of Labor, Office of National Programs. Their evaluation of this experimental model is excerpted from their letter to me as follows, and I quote them:

> We believe that the model has shown itself to be successful and adaptable to other occupational areas. As you may know, in addition to other activities, the Office of National Programs funds programs with a special nature or bearing upon national employment problems. The model programs you participated in developing fall within this category. The purpose for supporting most such efforts is that they may have some replicability in the State and local employment and training systems. Within this context, we believe that the model educational and training delivery system has been shown to be effective and is available to others who wish to use it.
>
> Further, we feel that the model lends itself to a variety of occupations and that potential users can make necessary adaptations accordingly.

Therefore, there are available at this time data bases which include hundreds of new forecast high tech occupations that can be created in the cities and States throughout the country. There is a validated national model in which we can place these new occupations and quickly set up effective training programs in the new high tech industries, thus minimizing the time for planning, the amount of money that will be wasted in repeating programs that did not work, and facilitate the benefits of the Job Training Partnership Act for all of those who may be enrolled in training under it.

Mr. Chairman and members of the subcommittee, I have attempted to describe some of the failures of our critical information systems and networks in the three departments. The three departments have been furnished copies of my testimony. According to what I hear, they are very much interested in my criticisms and my suggestions.

I have tried to indicate the severe penalties of proceeding without better navigation information, to indicate the potentials for creating many hundreds of thousands of new occupations; and, to advise that a validated methodology to create new occupations exists.

I will conclude my testimony with a quotation from a historical figure. Arnold Toynbee once described the rise and fall of nations under conditions very similar to the challenges to our Nation today:

"A young nation," he said, "is confronted with a challenge for which it finds a successful response. It then grows and prospers. But, as time passes, the nature of the challenge changes and if a nation continues to make the same once successful response to the new challenge, it inevitably suffers decline and failure."

Thank you for the opportunity to testify here today.

Mr. GORE. Thank you very much.

[The prepared statement of Clyde W. Helms follows:]

TESTIMONY
SCIENCE & TECHNOLOGY COMMITTEE
SUBCOMMITTEE ON INVESTIGATIONS AND OVERSIGHT
HEARING - APRIL 6-7, 1983

Mr. Chairman, Members of the Committee, my name is W. Clyde Helms, Jr., and I am President and founder of Occupational Forecasting, Incorporated. I wish to thank you for the invitation to present this testimony, and the opportunity to present to this Committee what is perhaps the greatest challenge in the history of education, employment and training.

While the nation struggles to cope with the overwhelming effects of high technology, high deficits, record unemployment and increasing costs of socio-economic programs, the Congress produces new education, jobs, and unemployment benefits legislation treating with the affects rather than the causes. In this testimony, I will urge The Congress to correct situations within the federal government which contribute to economic disarray throughout the nation - particularly in major cities and industries. I will focus upon three departments in the Executive Branch - The Departments of Education, Labor, and Commerce. The responsibilities of these departments bear directly upon the education, training, and employment of the national workforce.

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The august Council of Economic Advisors and other economists who advise the President and the Congress admit they do not know enough about employment and unemployment. Yet, they attempt to resolve the nation's most critical problem exclusively through manipulations of the nations financial systems. Such financial manipulations alone cannot achieve a correct solution. If such activities are taken in conjunction with correction of the many complexes I will describe here, there will be far better probabilities of lasting remedies.

> Arnold Toynbee once described the rise and fall of nations under conditions very characteristic of the challenges to our nation today. "A young nation, 'he said,' is confronted with a challenge for which it finds a successful response. It then grows and prospers. But, as time passes, the nature of the challenge changes and if a nation continues to make the same once successful response to the new challenge, it inevitably suffers decline and failure."

I will describe some of the challenges confronting us today, and the consequent penalties or successes - depending upon the nature of our response. The challenges to this Committee are for major changes in the three Departments noted above.

- PART I - DEPARTMENT OF EDUCATION -

A major cause of the economic problems facing the nation today is occupational obsolescence. The national workforce is obsolete. Sweeping, accelerating changes in technology and science have impacted every occupation in the nation's occupational infrastructure. The greatest impacts are yet to come, before the end of this century. Evidence of such great change is clearly visible in the multi-billion dollar federal and private sector research and development programs, the emergence of new industrial technologies, sciences and arts; the decline of basic industries, unfavorable import/export ratios; and record unemployment. No one familiar with the implications of these events will disagree that technological change will affect every occupation, at every level from laborer to the highest professions. As Lloyd Dobyns stated in the conclusion of the NBC TV Award winning white paper, "America Works When America Works," - "It isn't change so much, it is the speed of change!" I urge this Committee to assess the need for a priority national project to identify and to publicise "sunset occupations" and to replace these with new "sunrise occupations." Change is imperative for the nation's economic survival today and in the future. Some organizations may seek to delay these imperative changes - make industries and other employers retain employees in the old occupational classifications and wages established over decades, for obsolete occupations. The nation must recognize that the change Mr. Dobyns alluded to is the inexorable pressure of the 21st century workforce - only 17 years away.

Historically, structural changes in the workforce have evolved over decades. There isn't time for such evolution today, a new national workforce must be designed, engineered and emplaced as soon as possible. Such challenge has never occurred before. The 21st century workforce will not occur in some "Cinderella-like magic" at 12:01 on January 1, in the year 2001; it is being forged now in the new Computer Assisted Manufacturing (CAM) plants; in the engineering departments of Lockheed, General Motors and General Electric and Fujitsu Fanuc where Computer Aided Design (CAD) is creating radical changes in the ways engineers design, engineer and layout new designs; in the Flexible Manufacturing Systems and Flexible Manufacturing Cells (FMS/FMC) of the nation's major manufacturing plants; in the automated office, or office of the future. Truly, the speed of change is overwhelming the bureaucracies of the government and private industries. No important occupation will ever again be current for more than two years.

Technology half life is no longer a comfortable 5 years - perhaps 2 years in some technologies. What does such sweeping change imply for the nation's educational and training institutions? Does anyone know? Where are the assessments and impact studies? They do not exist. The nation is grossly unprepared! Yet, the challenges and opportunities have never been greater - or more imperative. As the currency of occupations is now limited to two years -- all education and training programs must be placed in a state of continuing revision and updating. This Oversight Committee should assess the accuracy of that statement and its implications for our education and training systems and institutions.

Can textbooks be updated and maintained current with such accelerated changes in science and technology? I am confident everyone will agree - the answer is an emphatic no. Some publishers have advised me that they cannot obtain new technological information in a timely manner. When they get such information, it is two to three years, or more, behind the current state of the art, or technology. When they get such information, they have difficulty finding a writer expert enough to write the new textbook. Writing the book takes about a year, another year is required for marketing the book and two or more years to get it onto the bookshelves and in libraries, and even longer before it is incorporated into curricula. Thus, it is rather clear - in this illustration - why we have been advised by our foremost competitor, Japan, that we "...should have started 30 years ago." (Advice given some of our industrialists on how we might catch up with the Japanese.)

However, the technology which is creating such demands upon education will also help with solutions. While computer assisted instruction has been around for some time, computers and software now being used in industry and in the automated offices provide new dimensions and techniques for use in vocational and technical training. I have confered with entrepreneurs who are already at work on designs for new equipment that will revolutionize the practice of human instruction and teaching. Some of the new occupations my firm has forecast for the education and training establishment seem more like industrial occupations - yet, with artificial intelligence, and CAD/CAM like equipment, great changes in education and training are in sight.

We have seen the rapidity with which popular songs can be taped and mass marketed. And we are intrigued by the intensity of interest shown by young people spending their allowances and earnings in the Atari arcades. Major corporations are now vying for the new market in educational materials. Audio-visual instructional cassettes can be produced rapidly in great quantities and updated at less expense than books. Expertly planned and programmed instructional materials are being developed that will free teachers from many of their teaching duties in overloaded school rooms. Students in all levels of education will work (one-on-one) with sophisticated "learning machines." Such teaching and learning machines will enable the nation to better meet the needs of the new high-tech work forces of today and the 21st century. The quality of education and training will go up; costs will come down. As a pioneer in computer assisted instruction, and the biggest employer and trainer of workers, the Department of Defense might pioneer in the use of these new machines.

I recommend to the Committee that conferences with the DOD be undertaken on a priority basis. Improvements in DOD training and the cost reductions that could be achieved would surely warrant serious consideration at the Secretary or Assistant Secretary level.

Experimental projects undertaken by DOD should include teams from the Departments of Labor and Education so that the benefits of DOD experience could be translated directly to the public and private educational institutions.

It should be clear to this Oversight Committee that professors, teachers, instructors, and trainers must be among the first to go back to school, or to gain experience in the research laboratories, computer managed plants, and automated offices. As a part of a national assessment, the Committee should note that programs, curricula, and textbooks should be assessed for currency. It does seem ridiculous to perpetuate education and training programs for obsolete or obsolescent occupations - at whatever level. Nevertheless, these instructional programs and materials will probably continue producing educated and trained persons for "sunset occupations" throughout this century.

While accelerated change in our educational institutions and programs is urgently needed, credentialing requirements will deter such progress. National accreditation associations and regional accreditation associations must accelerate their reviews and approvals of new degree and certificate programs. Again, lack of familiarity with the character of technology change will inhibit these associations. However, the nation can no longer afford the deterrent effects of time consuming reviews of proposed new degree and certificate programs. The very principle of awarding degrees and the values of such instruments may be shunted aside as imperative pressures compel employees and employers to concentrate upon courses and programs that enable them to remain abreast of actual employment requirements. As in educational administration, personnel administration and industrial relations staffs must now accomplish extensive revisions in all elements of their work. Education and qualification, wage and salary, and performance standards are no longer realistic and the roles and importance of such industrial specialists will be diminished.

As I have recommended a national assessment of programs, curricula, and textbooks, the Committee should give consideration to including assessments of the nation's credentialing requirements and the familiarity of credentialing staffs with the new world of work. Numerous articles published in some of our foremost journals are raising these questions. And while a national debate is predictable, it isn't difficult to predict that new education and training programs will not be held back while academicians and theoreticians debate todays values of yesterdays practices. Nevertheless, new means of upholding our traditional excellence must be devised.

To illustrate a point, my firm has conducted technology assessments of some of the new high tech industries, automated offices, genetic engineering breakthroughs, and other exciting developments of high technology and science. We have identified new occupational fields in which potentially many hundreds of thousands of jobs could be created. Recognizing the difficulties in credentialing systems, we have titled these new occupations as

Technicians. Though college level credit courses will be required in all of these technician occupations, I feel the new courses in new technologies, sciences, and arts must take precedence over some college courses required for degrees. Accordingly, we will recommend to educational and training institutions that concentration be upon the essential work-related courses, and while employed in these new occupations, the employees may take additional courses needed for the degrees. Hopefully, the Committee will raise the question - yes, but how long will it take to make all credential course work more closely related to the workers' constantly changing educational and training needs? Identification of obsolete and obsolescent occupations should facilitate such desired eventuality.

The Committee will recognize that the technological renaissance affects the nation's educational and training systems as much as it impacts industries, business, and commerce. The results of industry "sunsets" and "sunrises" carry portents as serious for educational establishments as in industries. Only those universities benefitting from large research and development funds can adjust to meet the challenges of technology change. It would seem there should be a requirement that these universities provide information on their research to other educational institutions in a useful manner - including perhaps assessments of the impacts of new R&D breakthroughs on existing curricula. Teaching professors and staff members cannot be expected to be sufficiently familiar with such new research and development accomplishments to be able to prepare new curricula and to teach such developments. Arrangements should be made so that teaching staffs either visit or participate in the research and development work at universities where such work is well funded. If the authority for promoting such activities on a timely and effective basis does not exist at the Department of Education, perhaps The Congress should provide such authority. It seems that the National Institute of Education might take this matter under consideration, as well as other matters discussed here. Perhaps the challenge of the 21st century workforce exceeds the authority and capabilities of the Department? Can the Department meet this challenge? I feel the Department - as organized and staffed cannot meet these challenges of the 21st century workforce. Rather, I have recommended that eminent leaders in our educational institutions convene a national conference to address these and other related matters and develop a new order that will endow institutions of higher learning with more independent authority and funds to act directly and indepently or in cooperation with others in responding to the needs of the nation. Slow moving bureaucracies, in the governments and in the private sector, cannot meet the challenges of such dynamic events today. The National Science Foundation has expended many millions of dollars for educational grants. Some who administered those programs admit it is difficult to identify direct benefits. The Congress should consider how to encourage such independence of the universities and help these institutions to exercise their private initiative in meeting the nation's urgent needs. Their continued dependence upon and regulation by federal departments will result in serious penalties for the nation and the people. The present educational establishment, overall, is as poorly prepared to meet the challenge of the 21st century as the nation was prepared militarily for the attack on Pearl Harbor. Today, it is the economic viability of the nation that is at stake.

A new high tech work force will enable the nation to prosper and enjoy its investment of billions of dollars in new high tech industries, business, and products. Creating a new workforce is the greatest challenge ever to the vocational education and training establishment - public and private sector. The President has submited proposals to The Congress in which parents would be better enabled to pay for education in private institutions, or public institutions according to their determination of which better meets the needs of their children. With the future of the nation and each individual more dependent than ever upon the availability of a broad range of quality education and training programs, individual decisions on how to use available resources should be encouraged in line with the responsibilities for their career success. This Committee should consider whether the educational establishment has met its responsibility to the nation and whether or not federal departments can function sufficiently well in these respects, in an era of continuing technology change. To what extent, if any, can the activities of the Departments of Labor and Education be turned over to the private sector? An unemployed workforce of approximately 10 million people, would seem to demand immediate action.

Vocational training in public schools seldom compares with that in private vocational schools. It seems that the importance attached by public school officials to this form of career development leaves too much to be desired. Vocational training must be seen in a more important role. The competency of the nation's workforce is a critical element in international trade - isn't it time The Congress recognized this fact and acted to bring this economic element into the economists' calculations and theories? Like investments in industries, investment in vocational and related training should be viewed in capitalization plans and measurable benefits. It is time for employers to place accountable values on human capital and to account for their usage and investments here as they do for other assets.

Costs of vocational training on new high-tech equipment and systems will increase substantially. Complex, sophisticated equipment, materials, and processes are costly. I question whether at the secondary or the two year junior college level, the costs of such equipment and competent instructors can be borne. Equipment used continuously for technical training has a high failure rate. Costs of replacement parts add to the costs of training. Warranties generally do not apply to equipment used for training purposes. Again, given the speed of technology change, this expensive equipment will quickly become obsolete. Much of the equiment now in the vocational schools is already obsolete - some of it dating back to World War II. The Committee should consider the costs to the future workforce of training youth and new entrants on equipment of the mid-industrial revolution era. One computer manufacturer has recognized this problem and offered to provide a computer to each school; other computer manufacturers are now making the same proposals. The commite should consider this unique employer evidence of the values they place upon vocational training. Worldwide sales of microchips are forecast to surge from $14 billion in 1981 to $27 billion in 1985, and $100 billion by the year 2000. Jobs for computer programmers have been forecast as increasing by 10,000 a year through 1985. When one considers the "economics of big business" - such as computers, communications, genetic engineering and biotechnology, and robotics - the essential interdependence of human capital will be factored into economic and financial formalae. I urge this Committee and perhaps the Congressional Office of Technology Assessment to provide the leadership in developing new principles for weighting human capital in technology and industrial finance. For too long, The Congress has appropriated billions of dollars in actual funding and tax benefits to promote the advancement of science and technology research without requiring assessments and cost-benefits analyses of the resultant effects upon the workforce. Surely, the Japanese have shown us the folly of such oversight, for it is U.S. science and technology they have exploited in seizing so much of world commerce; including notably heavy inroads into business and commerce right here in this country. Our vocational training institutions and programs must exemplify all the qualities that we expect in our industries. If pride in work and productivity in our industries are to match, and hopefully, exceed that of the Japanese, then these qualities must be inculcated during the training of the new workforce. It is a sad reflection of our once greatness that educators and industrialists from this country now journey to Japan to learn from their educators and industrialists and return and proclaim that they are setting up "Quality Circles", and adapting other principles of Japanese expertise. Though I am, in this testimony, severely critical of the federal departments, it should be quite evident that their oversight reflects congressional oversight for some years. Governors' employment and training staffs have advised me that without information as to what are or will be the new high-tech occupations, the JTPA programs can only be a rerun of the CETA programs and many thousands of trainees will be trained in the same occupations in which many thousands of former employed experts now line up in queues at unemployment offices throughout the country. I urge the Committee to take steps immediately and initiate a national project of occupational assessment and forecasting. Otherwise, we will fulfill in this latter part of the 20th century the philosophy of Arnold Toynbee.

A new beginning, a renaissance for vocational training, is clearly in the interests of the nation and its people. The character of the 21st century workforce will depend substantially upon the character of vocational training. This essential national resource must be protected and promoted with all due recognition of its economic importance. Vocational training is not just a "trade school concept" - it must enjoy the status of higher educational institutions. Doesn't everyone go to school to enrich and better their lives? Don't lawyers, doctors, financiers, and other "professionals" study and train for excellence in their professions? But, will funds for "vocational training" ever match funds for higher level education and training? Perhaps the scientists and technologists on this oversight committee would find some of these comparisons more acceptable if they were backed up by cost-effectiveness studies. I agree that such studies are urgenty needed - but who is producing that information? The Congress has appropriated tens of millions of dollars for education research. The National Institute for Education (NIE) is well conceived for such important research, as is the Department of Labor Employment and Training Office of Research and Development. I am hopeful, the General Accounting Office staffs testifying before this Committee will support my call for an investigation into the costs and benefits of such substantial expenditures. I am confident that those in the GAO to whom I have furnished information will endorse my requests for action, and indicate wherein these research organizations have failed to exercise proper foresight.

I see no way in the near-time-frame whereby vocational training institutions will have the necessary funds to provide the requisite training in new technologies, sciences, and arts. Costs of new technologies hardware and systems are prohibitively high for these institutions. Obviously, employers must assume a greater role than ever before - it is certainly within their "bottom-line" interests to do so. And, as indicated by previous remarks - many are already moving in that direction. The alternative for employers to provide sufficient help to private and public institutions is to do the whole job themselves. Analogously, we may find that vocational training institutions will have to be built in the parking lots of the major corporations. That is the only place where current "hands-on" training can be accomplished on-the-job, working with production equipment and systems. That is one of the salient differences between the CETA and the JTPA. The latter Act provides training funds to employers. Whether in the automobile plants or the intensive care units of hospitals, programs such as work-study and cooperative education appear to be among the most effective ways to meet the constantly changing requirements of a high technology workforce. Changes in vocational training must match changes in the nation's high-technology workforces. Requirements for changes in vocational training will thus be as constant, as intense, and as imperative as the technology changes upon our industries.

Is The Congress allocating and expending education and training funds appropriately, in the best interests of the nation? Why are essentially complementary education and training responsibilities divided between the Departments of Labor and Education? Is this cost effective and beneficial? For example, why shouldn't the Office of Vocational and Adult Education (OVAE) be co-located with the Bureau of Apprenticeship and Training (BAT)? Why shouldn't the National Institute for Education and the DOL Office of Research and Evaluation be integrated? Is this separation of education and training research influenced by academic philosophies which no longer obtain, by beliefs that one comes under the purview of educators and the other, under the purview of labor? Is it because The Congress perpetuates this ineffectual division in its budgets of the two Departments; or that The Congress cannot take the time and do the work needed to review and re-write Acts that have piled on top of each other for decades? I trust in this testimony I might influence this Oversight Committee and you will conclude that Congressional oversight compares with that of the Executive Branch Departments. The following testimony will treat more specifically with definable oversight situations in the Departments of Labor, and Commerce.

- PART II - DEPARTMENT OF LABOR -

The Department of Labor (DOL) publishes the nation's Dictionary of Occupational Titles (DOT). This volume of 28,000 occupational titles includes 12,000 titles with supporting definitions. 8,000 titles without definitions purportedly relate to the 12,000 defined occupations - though no one can define that relationship. The remaining 8,000 titles are without any definition. The DOT is the "keystone" of the nations occupational infrastructure. It is the source of occupations for which the DOL Occupational Outlook Handbook forecasts job employment opportunities, the Bureau of Apprenticeship and Training approves occupations for the national apprenticeship program, and for the BLS reports on employment and unemployment statistics to The Congress.

The Dictionary is updated and republished decenially, concurrently with the Census. The Fourth Edition was released in 1979. Change sheets are issued or available at unspecified times. It is obviously impossible to insure that such change sheets reach all who have purchased the DOT. Dictionary staff have advised me they have no directive or administrative methodology for eliminating obsolete or obsolescent occupations listed in the DOT. Exhibit 1 is a set of terminology used by my firm for identifying and assessing obsolete, obsolescent, current, new, and emerging occupations.

Similarly, the DOL staff has no methodology for identifying needs for new occupations in new and emerging technologies, sciences and arts. There is no program in the federal departments or the private sector to forecast and create new occupations. Obviously, the national occupational infrastructure must be replete with obsolete and obsolescent occupations. Educational and training institutions do not have urgently needed information as to what are the new occupations.

Exhibit 2 is a listing of some new occupations I have designed and proposed for development. Other occupations have been designed and are being presented to Governors' Employment and Training staffs for use in implementing the JTPA, to Chambers of Commerce Economic Development Administration staffs, and to corporate officials, and education and training associations. Potentially, hundreds of thousands of jobs could be generated in these new occupations, and additional thousands of essential new occupations could be designed if an active national program could be established for such purpose. I propose this be a collaborative effort by national industries associations working with institutions of higher learning - particularly those benefitting from large R&D funding. At this time, my firm is the only organization in the country doing this work. We have inquiries from a foreign government and correspondence exchanged with another. Proposals for such programs have been submitted to the DOL, and the Department of Education.

Given the rapid pace of changes in industry, commerce, and business, no printed dictionary will ever be current. The nation needs a real time computer based occupational and employment information system. While the New York Stock Exchange can handle and report stock transactions well in excess of one hundred million shares, amounting to many billions of dollars, the nation does not have a system for real time employment opportunities reporting. The Congress has directed the DOL, in both the CETA and the JTPA, to "...establish and carry out a nationwide computerized job bank and matching program...on a regional, state, and local basis, using electronic data processing and telecommunications systems to the maximum feasible extent possible for the purpose of identifying sources of available persons and job vacancies..." The Committee could ascertain whether such systems exist and are functioning as intended by The Congress.

"Job Bank" computers are presently used for storing employment opportunities information gleaned over a period of up to three months, collected by correspondence and through exchange of microfiche records furnished by state and city employment services. A newspaper-like publication - Occupations in Demand at Job Services Offices - sets forth such information. Distribution of this publication cannot possibly meet the demand - even if the information were current and usable. In a personal telephone survey of employment offices in several states, I found that few of the employment staffs were aware of such information, that some were keeping it on microfiche file, that job opportunities listed were out of date, and that the sources could not be identified. The publication must be seen as a failure; the requirement for a real time occupational information job bank must be seen as a failure; compliance with the requirements set forth in these Acts is a failure.

Nevertheless, the need for a real time occupational and employment system network must be met. The Committee should promote assistance by the Department of Defense (DOD). DOD world-wide real time data bases represent a state of the art far exceeding the comparatively simple requirements for a national jobs data bank. The JTPA includes provisions for the DOD to provide assistances. If The Congress or the Office of The President were to implement this suggestion, I would estimate two or more years would be needed for implementing such a national system. I believe, as a matter of scale, the NASDAQ Network is of comparable scale, (National Association of Stock Dealers Automated Quotation). As will be described in the following, the departments have been unable to produce a uniform system of occupational definitions, codes and statistics. It may well be that the job is too big and complex, requiring technical systems skills and knowledges not available in these departments. Surely, any further consideration of such networks should include the possible economies and other attainable benefits that could be derived if this system were to be designed and operated by the private sector. As recommended previously, perhaps consortia of industries associations and educational institutions could operate such system.

The inadequacies of DOL dictionaires and subordinate publications has been described. Additionally, the Committee should consider investigating the utility of occupational information published by the Department of Education, Office of Vocational and Adult Education (OVAE). Vocational Educational Codes are disseminated through their Vocational Education Data System (VEDS). Why are these codes necessary? Why not use the DOT? Both DOL and Department of Education staffs have spent uncounted hours of effort over a period of years trying to develop a "cross-walk" (correlation) between these codes. The Department of Education staff advised me the problem is compounded when the National Center for Education Statistics attempts to compile statistics developed from differing bases. As in the DOL Occupational Outlook Handbook, the National Center for Educational Statistics produce data to serve the educational establishment. The only recourse conceived by staffs in the departments, and supported by the Congress, is the establishment of a National Occupational Information Coordinating Committee (NOICC). That Committee has extended its statutory mandate by promoting establishment of State Occupational information Coordinating Committees (SOICC). Yet, the operation of irreconcilable data bases continues without improvement. Obviously, the value of these extensive and expensive networks depends upon the quality of information distributed through the "pipe line." Officials with whom I have discussed this problem generally agree that the rapid pace of technology change today and in the future has overtaken the occupational information now transmitted through this network. If the quality and quantity of occupational statistics and information could be upgraded to meet the needs of today, the NOICC and SOICC could become useful means of transmitting information between offices at this level. However, another question remains as to how effectively this information would be used by local employment services agencies. The JTPA authorizes funds for labor market information (LMI) research. To the extent that such funds are used to extend present methods of occupational information dissemination, this Committee would be advised to monitor such expenditures closely. Current, valid information on new occupations does not exist.

This poses the question of how public employment services offices can match unemployed workers with the "new work, out there." They cannot. One hears so much about "structured unemployment" and while that term has as many definitions as sources that use it, The Congress should recognize that much of the unemployment today is due to the inability of employment services staffs to match applicants with new technology jobs that aren't listed in the DOT, or other government furnished occupational information. Even were current high tech jobs information provided to employment placement officers and counselors, many are unfamiliar with such new technology and cannot interpret such job requirements and cannot relate these to the qualifications of previously employed highly qualified machinists, tool and die makers, electronic technicians and other craftsmen. Consequently, the best way for persons with such technical skills to find jobs in the new high tech workforce is to search the newspapers and professional journals want ads. Many of the new high tech firms have increased their recruitment staffs and displaced workers who have found such employment on their own initiative will advise the Committee there is no comparison with the services and comprehension of state and local employment offices staffs and those of the corporations. Corporate recruiters will probably advise you they do not place requests for recruitment with public service employment offices as the staffs there are unable to understand the highly technical character of positions available. Within a few more years - when the numbers and types of high technology occupations will have increased greatly - one might question whether state and local public service employment offices can be depended upon to do the work efficiently?

In workshops conducted in several states, I have discussed with educators and officials of major corporations the concept of national industries associations forming occupational information networks in which occupational definitions and employment information would be pooled and processed through private sector clearinghouses. (The Department of Commerce National Technical Information Center is somewhat illustrative.) I wish to inform the Committee there is definite initerest in this idea; some of the discussions are moving into the system concept stage.

As mentioned previously, occupational and technological information would be disseminated by associations' occupational analysts. Aggregated occupational and employment statistics would be provided to a national clearinghouse. All of this information would be available on a real-time basis to educational establishments. This assistance would enable institutions to update existing curricula and to develop new education and training programs in a more timely manner. Further, university, college and high school staffs could assist in developing new educational qualifications requirements for new and updated occupations at associations' occupational clearinghouses.

If we can resolve the problem of providing current occupational information to state and local employment services agencies, the Committee should consider how the matching of unemployed persons with new job opportunities can be improved. As noted, it isn't necessarily the qualifications of unemployed persons that determines whether they succeed in getting a job through the offices. The capabilities and interests of employment staffs are a factor. Accordingly, ways must be identified to bridge this deterrent.

The means are readily available to implement far more effective procedures - procedures in which placements of unemployed persons are not dependent upon the knowledge and capabilities of employment counselors. National networks gather news reports from all over the world every evening. Network reporters here in the states interview their reporters face to face in countries and remote areas all over the world. Members of Congress and other distinguished persons are interviewed in their offices, talking with reporters in Washington, D.C., New York, and other major cities. Side by side, face-to-face interviews are presented routinely on the TV screen. This technique could be cost-beneficial if implemented by state and local employment services agencies - within the states, and between states. The video telephone is an accomplished state of the art and within the time to design and implement such vis-a-vis employment interviews, that telephone system could be an integral feature. Whether by the telephone or by present teleconferencing systems, major changes must be made in the present inefficient methods used by public service employment interviewers attempting to place unemployed persons in new jobs. Again, the JTPA provides for research funds to be expended in developing labor market information (LMI). Pilot experiments might be commenced in major cities where reduction of high unemployment rates justify costs of such pilot experiments.

I have attempted to explain why present labor market information is grossly inadequate - in fact, to the extent it misleads unemployed persons concerning the long term employment potentials of obsolete or obsolescent occupations, it merely shifts today's problems to tomorrow. Computer dating games do it better. Nevertheless, I submit that with such electronic employment systems as described here, we can generate the highest potential employment and benefits. Without such systems, unemployment will continue to increase with the advances of technology, science, and the arts.

The national costs of occupational obsolescense are incalculable - perhaps some competent economist can derive acceptable estimates. The ability of the nation to compete with other nations in world markets and even for our internal markets is well described and documented in the media. While the highest officials of nations meet in international summits to discuss trade and all the elements affecting commerce, our basic industries have suffered losses on the order of 30% or more - steel, textiles, electronics are but a few examples. In debates with officials of other industrial nations, and emerging nations, the high costs of U.S. labor has been constantly noted as a primary factor in export/import imbalances. Japan, more than any other nation, has forced us to critically examine the cost of human intervention in all production processes. To compete with Japan's industrial prowess, much of it built upon new production techniques, management, and U.S. products and technologies - the U.S. and other nations rush into computer assisted manufacturing, computer aided design, flexible manufacturing systems and flexible manufacturing cells. The use of these new production technologies at this time favors the U.S., where leadership in such production systems remains. But, this benefit can be lost if a new workforce is not designed and put into place as quickly as possible and feasible.

The benefits of our research have been extended to all technologies, sciences, and arts. And while the nation's hi-tech revolution has been on-going, the nation's apprentice training programs plod along enrolling and graduating apprentices in crafts and trades of decades past. Where are the apprenticeships for the new technologies? They don't exist. As a former director of Navy apprentice programs, I know that one of the most difficult administration tasks is to insure that apprentice training programs are constantly updated and retained abreast of new technologies. I doubt such administrative pressure is exerted in the nation's industrial apprenticeships. Some of these plans are, perhaps, still printed on mimeograph sheets of years past. Apprenticeships are a primary source of recruitment and enrollment of union members. The effects of obsolescent apprenticeships may be seen in the heavy losses of union members' jobs - jobs that are "gone forever." But these apprenticeships are continuing. At a time when the Congress has appropriated billions of dollars in tax concessions for the industries to rebuild plants - where is the essential accompanying assistance for the nation's apprentice training programs? Will the Congress permit this essential program to fade into the history of the industrial revolution? In my remarks about vocational education and training, I noted that the high costs of hands-on-training will never again be within the funding range of high schools - or, for that matter even some post secondary education institutions. The apprentice program administered by the DOL is based upon the Fitzgerald Apprentice Act of 1937. Isn't it long past time for the Congress to update that Act? Many of the challenges presented here should be addressed in any such update - or new legislation superceding that Act. Legislation such as the Davis Bacon Act, and the Walsh Healy Act should be evaluated in any new legislation. It does appear that the Congress has for the most part overlooked the nation's apprentice programs. It is late, time is critically short. The Congress can pull this crucial program out of the mothballs and turn this valuable concept into a useful system for upgrading the national workforce. The JTPA recognizes that realistic training can best be accomplished by private sector employers, on the job. Apprentice training programs provide that kind of training.

There are approximately 300,000 apprentices enrolled in federal and state programs, 20% - 25% are in manufacturing - metal trades. Most of the others are in the building and construction trades. I will assert unequivocally, the apprentice programs have been overtaken by new technologies. Metal working trades are most impacted by the new production technologies. Unemployment in this sector is probably the highest of any sector. While advances in manufacturing technologies and displacements of hundreds of thousands of auto workers and others are well publicised, there is no plan to identify and publicise obsolete occupations, or to discontinue these apprenticeships, or, to establish apprenticeships in the new technologies. Why is this? For one reason - among many others - the Fitzgerald National Apprentice Act and subsequent policies have produced interpretations that only those occupations listed in the DOT can be apprenticed. Further, administration of these programs is encumbered by divisions of authority between federal and state apprentice councils and statutory provisions requiring employment and wages to be in consonance with collective bargaining agreements negotiated by the unions. Surely, this vital program deserves more current and realistic legislative guidance and support. I submit this is a major area for oversight investigations and remedial legislation.

- PART III - DEPARTMENT OF COMMERCE -

The preceding testimony has dealt with situations in the Departments of Education and Labor. And, while I am inclined to discuss similarities in the U.S. Civil Service, I will conclude this testimony with comment on the employment and unemployment statistics used by the Congress in assessing national employment, unemployment, and associated legislation.

The Congress must recognize employment and unemployment statistics are of questionable validity. In fact, the extent of errors is potentially so extensive that the Congress should have serious reservations about passage of any legislation deriving from Bureau of Labor (BLS) statistics. One might argue that even inaccurate statistics might be useful in indicating trends - since such invalid statistics have been in use for years. I feel the Congress will not accept that argument. Further, if the Congress takes into consideration the absence of any system to create new occupations, and to identify the obsolescence of thousands of present occupations listed in the DOT, VEDS, Occupational Outlook Handbook, and Department of Commerce data (as described in the following), it will probably agree with the remark of some of the Joint Economic Committee staff following a briefing for them - "Garbage in; garbage out." Can the nation afford to expend billions of dollars for new jobs programs on the basis of such "garbage"?

It is well known among occupational authorities of the three departments that the BLS cannot establish a valid "cross-walk" between the occupations used by the Department of Commerce Current Population Survey (CPS) data, and occupations in the DOT. Nevertheless, CPS statistics are a major factor in BLS employment and unemployment statistics reported to the Congress. Further, the CPS statistics are used by the DOL to forecast employment for jobs listed in the Occupational Outlook Handbook.

The Department of Commerce Demographic Survey Division, Current Population Survey Branch, is responsible for the conduct of monthly surveys of approximately 58,000 households located in 629 Population Survey units. These are geographical units determined on the basis of population densities. Approximately 60% of these surveys are made by telephone calls, 40% by direct visits - usually in first contacts with a household. The surveys are conducted on the basis of a printed questionnaire. In a previous study of that questionnaire, it appeared to me that much of the information required in completing the form is ambiguous and introduces an undetermined error rate. Further, the accuracy of response information is affected by the education and experience of respondents, including their understanding of the occupations for which employment or unemployment information is elicited. Some of the Department surveyors advised they were not fully familiar with the occupations on which information was obtained. For some years, the CPS Branch has used "400 groupings of occupational titles" (without definitions). This has been changed recently in attempts to correlate response information with

Department of Commerce Standard Occupational Codes (SOC). Previously, the staffs recognized the impossibility of establishing a "cross-walk" between the "400 occupational groupings" and the DOT. And, as noted previously, Department of Education staffs admit to difficulties in establishing a "cross-walk" between their VEDS codes and the DOT. These difficulties are further compounded in BLS statistics by the inclusion of employment and unemployment statistics from various industries and unemployment compensation statistics. To what occupations do these statistics relate? I am confident this Committee on Investigations and The Congress can see the need for investigation into these conflicting data systems. And, I might suggest that the Congress express reservations henceforth in passing new legislation dependent upon these statistics.

What will the Congress do? The Congress should address itself to the greatest task ever confronting any nation's legislative body - to design and engineer a new national workforce. The magnitude and complexity of such undertaking will challenge the entire Congress. But, as the chairman of one of the nation's major corporations noted in an address at Notre Dame, "What is at stake is a way of life we have taken for granted in this century." Another official in one of our major automobile manufacturing corporations advised me - "This is one competition we must win; we may not have another opportunity in this century, or the next." The architectual elements for a new national workforce are indicated in this testimony. Will the Congress be the architect of our new workforce?

Thank you for this opportunity to testify before the Science and Technology Subcommittee on Investigations and Oversight.

W. Clyde Helms, Jr.
President
Occupational Forecasting, Inc.

TESTIMONY - HOUSE SCIENCE AND TECHNOLOGY
SUBCOMMITTEE ON INVESTIGATIONS AND OVERSIGHT
APRIL 6-7, 1983
MR. HELMS -- EXHIBIT 1

A STRUCTURE FOR ASSESSING OCCUPATIONAL CLASSIFICATIONS AND FORECASTING NEW NATIONAL WORKFORCE OCCUPATIONS (C)

The purpose of this structure is to provide employers, employees, educators, and students, and others responsible for maintaining a current and effective national workforce this terminology for assessing the status of the workforce, and, identifying and acting upon evidence of **obsolete and obsolescent occupations, and new, emerging, and emergent occupations**; to take such steps as are indicated in promoting national and individual interests. There is no system such as this in operation within the United States, or any other industrial nation. It is believed establishment of such system and publication of information derived through the following assessment and forecasting classifications will be of nationally significant value in advancing the interests of the people and the nation.

. . . .

Obsolete Occupations. Those for which there is no present or foreseeable direct economic value when compared with employers' and employees' sustaining income requirements; and, in which levels of employment have decreased to a minimum percent of previous employment, over a reasonable statistical period of time. Such occupations may be discerned at an early state in minimal growth demand - compared with all other occupations - and diminution of wages and salaries. Other indications will be noted in the workplace and job security of employees.

Obsolescent Occupations. Those for which conditions described under **Obsolete** can be forecast within a reasonable statistical time - for example, 5 years minimum. Such occupations may first be discerned in occupations characterized by **slower growth** (numbers employed and/or compensation levels) **compared to the average growth of all occupations**. A significant indicator may be noted in related education and training requirements, changes in appropriate sciences, technologies, and arts. Assessment and evaluation of these conditions and other impacts will enable the analyst to identify obsolescent occupations.

Current Occupations. Those for which there is a strong present and foreseeable requirement, with associated economic benefits for employers and employees. Such occupations generally reflect averge **or faster than average growth compared to all occupations**. Some of these occupations may not be in the paths of advancing

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technologies, sciences, and arts - demand may be based upon conditions not affected by or minimally affected by such new developments, or, the need for such occupations may be tangentially improved by such changes. Economic and other conditions support reasonable longevity of these occupations.

Emerging Occupations. Those for which new employment opportunities are well evidenced in the changing patterns of business, commerce, industry, science, technology, and appropriate arts. Such occupations generally do not have a well defined occupational title, or qualification and employment classification and wage standards. These appear rather amorphous, but, sufficient employment is occurring to identify this occupational area. The numbers of workers employed in this emerging occupational area are likely to be growing at a rate substantially above the average of all occupations; new educational and training programs are being established and demand exceeds supply, shortages are clearly evident.

Emergent Occupations. Those for which early trends in research and development, and the establishment of new industries, businesses, commerce, and other income producing activities evidence needs which require substantive qualification and lead time preparation by educational institutions, employers, and workers. Impacts upon the workforce evidence needs for substantially different work skills and educational qualifications. Employment, placement, and wage and salaries standards have to be revised or developed anew. Evidence of present and future requirements for these emergent occupations first appear - for example - in research and development projects, formation of new - or, substantive changes in existing - industries, businesses, and commerce and other major areas of employment affected by the need for such occupations in meeting predictable employment requirements.

CONCLUSION

Note 1. In the absence of any officially recognized system for assessing the currency of occupations comprising the nation's occupational infrastructure, these definitions have been designed by the author and will be furnished to contemporaries for comment and publication.

To the extent possible, the author will correspond with organizations concerning suggested changes.

In the final development, it is the play of the market place that will produce such definitions and use these in promoting and maintaining up to date national occupational infrastructures.

Note 2. In the interests of promoting discussion, analyses, and development of nationally acceptable terminology, requests for permission to quote from and to reprint this material will be considered.

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TESTIMONY - House Science and Technology Subcommittee
on Investigations and Oversight
April 6-7, 1983
Mr. Helms - Exhibit 2

Excerpts From OFI
Occupations DB-1

Copyright - Occupational[1]
Forecasting, Inc. June 1981

NEW OCCUPATIONS FORECAST

Technological Occupations Forecast	Forecast Estimates - 1990		
	Job Demand Forecast[2]	Salaries[3]	
		Starting	Mid-Range
1. Hazardous Waste Management Technician	300,000	$15,000	$28,000
2. Industrial Laser Process Technician	360,000	$15,000	$25,000
3. Industrial Robot Production Technician	400,000	$15,000	$24,000
4. Materials Utilization Technician	210,000	$15,000	$24,000
5. Genetic Engineering Technician	200,000	$20,000	$29,000

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[1] Copyright waived for use by The Congress.

6. Holographic Inspection Specialist	160,000	$20,000	$28,000
7. Bionic-Electronic Technician	120,000	$21,000	$32,000
8. Battery Technicians (Fuel Cells)	250,000	$12,000	$18,000
9. Energy Conservation Technician	310,000	$13,000	$26,000
10. Housing Rehabilitation Technician	500,000	$14,000	$24,000
11. Emergency Medical Technician	400,000	$16,000	$26,000
12. Geriatric Social Technician	610,000	$15,000	$22,000

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1. Based on Implementation by Mid-1980s.
2. 1982 Dollars.

Excerpts From OFI
Occupations DB-III

Copyright - Occupational
Forecasting, Inc., August 1982

NEW OCCUPATIONS FORECASTS

Computer Interface Occupations-Operators	Forecast Estimates - 1990		
	Job Demand	Salaries	
	Forecast	Starting	Mid-Range
A. Technical-Industrial			
1. **Computer Graphics Technician:** Terminal Operator (All Divisions of Graphics, Composition, Illustration, Art)	150,000	$20,000	$35,000
2. **Computer Drafting Technician:** Terminal Operator (CAD-CAM) All Areas of Design and Drafting (Technologies, Businesses, Sciences)	300,000	$18,000	$30,000
3. **Computer Modelling and Simulation Technician:** Computer Assisted Design Terminal Operator - Design, Testing, Evaluation	300,000	$25,000	$40,000
4. **Computer Assisted Manufacturing (CAM) Technician** Factory Onsite Monitor/Controller - Robots, FMC, FMS	120,000	$30,000	$40,000

B. Office-Business/Commerce

1. **Computer Terminal Information Processor**: Text, Data, Graphics - Applications in Offices, Industries, Institutions	270,000	$20,000	$30,000
2. **Computer Terminal Distributive Information Processor**: Electronic Mail, Electronic Funds Transfer, Information File and Retrieval, Telecommunications, Teleconferencing	140,000	$20,000	$35,000

C. Technical-Industrial

5. **CAG Terminal Input Artist**	150,000	$18,000	$25,000
6. **Computer Modelling and Simulation Technician**	300,000	$25,000	$30,000
7. **CAD Terminal Product Engineer**	450,000	$14,500	$27,000
8. **CAD Terminal Parts Cataloger**	125,000	$11,000	$17,500

Mr. GORE. We will withhold questions until we have completed the panel.

Brian Usilaner is the Associate Director of the Accounting and Financial Management Division of the National Productivity Group in the GAO.

You are accompanied by Charles Fritts and David Solenberger and——

Mr. USILANER. Morey Chick.

Mr. GORE. Thank you very much.

Feel free to summarize those portions of your testimony that are susceptible to that technique, and please proceed.

STATEMENT OF BRIAN USILANER, ASSOCIATE DIRECTOR, ACCOUNTING AND FINANCIAL MANAGEMENT DIVISION, U.S. GENERAL ACCOUNTING OFFICE, WASHINGTON, D.C., ACCOMPANIED BY CHARLES E. FRITTS, DAVID SOLENBERGER, AND MOREY J. CHICK

Mr. USILANER. Based on GAO's past and ongoing work, I would like to cover briefly today in my testimony automation, its impact on the work force, and the importance of labor market planning in policymaking.

The witnesses this morning have already covered the importance of improving our Nation's productivity to be competitive in the world markets. Automation is certainly a key ingredient to improving productivity.

Unfortunately, automation is a double-edged sword. While it can help our competitiveness, it can also hasten and exacerbate our employment problems. Still, we must be realistic in our expectations of how rapidly and how effectively these sophisticated systems are likely to be put into place and, based on these judgments, what the impact will be on the workforce.

Today serious impediments exist in this country in the development and integration of automation technology. These impediments fall into four categories: technical, financial, organizational, and social.

Technological impediments center around the incompatibility of the machinery and programs, usually referred to as the hardware and software. Until compatibility is achieved, the many diverse components cannot be integrated into efficient manufacturing processes.

Current market practices by component makers tend to discourage this integration. These manufacturers often make their components unique rather than compatible in order to gain an assured market niche. Meanwhile, manufacturing firms that could benefit from such integrated systems are being provided only components, not systems.

Integration, if done at all, must be done by the users who typically lack the engineering talent to design and integrate their own systems.

Financial and market barriers are those which discourage investment in automated devices, such as high interest rates, the tendency of businesses to focus on short-term needs, and other capital investment considerations such as cash flow, cost recovery, and the risk inherent in new, untried, and rapidly advancing equipment.

We use the term "organizational barriers" to distinguish between today's tradition-bound manufacturing organization and tomorrow's factory of the future. Today we see tightly compartmentalized departments for all functional operations. Fully integrated systems, on the other hand, mean that the organization itself will be integrated, eliminating several tiers of the structure, and streamlining the middle management and overhead areas, in particular.

Finally, the social barriers are based on human resistance to change, which we have already heard so much about this morning.

Despite these barriers to automation, the magnitude of our national economic problems, such as rising labor costs, decreasing competitiveness, and shrinking market shares, are forcing us to turn to technology as a way of regaining productivity and market share. These conditions will likely continue to stimulate both development and use of automation technology. But what is the potential impact of this automation on the work force? To assess this, we must address two basic questions: One, how rapidly will automation spread and, two, how sophisticated and integrated will these automated systems be?

Slow incremental installation of individual components such as robots and numerical control equipment will probably moderate any employment impact. On the other hand, sophisticated fully integrated systems may radically change the employment picture. However, because these integrated systems are expensive and the talent needed to design, install, operate, and then service them is scarce, it is unlikely, we feel, that we will feel any severe impact on the labor force for some time.

Presently, we are witnessing renewed concern because of the expanded uses of automation in virtually all sectors of the economy. The extent of long-term worker displacement caused by automation is currently the subject of much debate. There is, however, wide agreement that some short-term displacement in skill shifts is already occurring and will continue to occur.

The key issues for policymakers, and therefore for forecasters, we believe, are, one, whether automation's impact will have the effect of causing long-term structural unemployment; two, whether shifts in skills for most workers will create higher or lower skill demands. The accuracy of these judgments will largely determine how effective Government policies for education, training, and retraining will be.

There is a widespread belief that high technology will require workers to have more sophisticated job skills, but the total number of workers affected may be small compared to rates of growth in low skill occupations, such as janitors, nurses' aids, sales clerks, and the like.

Understanding how these changes might come about and the problems they might create is extremely important in labor market planning. Government labor market planning entails identifying potential imbalances in labor supply and demand, publishing that information, and encouraging workers to train for occupations where there are shortages.

Generally, such planning requires obtaining information on the labor market, developing methodologies to forecast supply and demand, disseminating forecast results to potential users, and, finally, evaluating the impact of Federal pcograms on the labor market. Each of these criteria is far too complex to discuss today in length. Therefore, let me give you a brief overview of each and then point out some of the problems relating to them.

Labor market planning requires comprehensive occupational data on national, State, and regional levels about both labor supply and demand. One problem in forecasting is that relevant supply information is often missing. For example, no centralized single data base is available consolidating information on all current graduates seeking work in a specific occupation. Further, detailed supply information by skill or experience level is virtually non-existent, and more work is needed to better determine how to measure potential labor supply.

In addition, occupational demand, on the other hand, is easier to estimate than labor supply, especially in the short term. Still, errors are made here as well.

Since demand estimates must be made by skill level and region, comprehensive surveys of current job openings or vacancies can give a good starting place for forecasting current labor demand. However, as with supply, it is important to break down demand by skill level and experience.

Occupational forecast accuracy depends on the reliability of input data and modeling techniques used. If the data and techniques used are inaccurate, forecast errors are to be expected. People using incorrect information may enter a surplus occupation or they may not train for a shortage occupation.

Such factors affecting input data may include, though not be limited to, overly optimistic assumptions in economic forecasts, inadequate labor supply and demand information, lack of knowledge about the interaction of labor supply and and external factors, such as rapid technological change, that disrupt the economy. Aggravating all these input data problems is that the information must be broken down to the State and sometimes local labor markets.

Despite the errors that occur, labor market forecasts are indicators of future skill needs, at least on a national basis. While not the sole consideration in the decisionmaking process, forecasts aid national, State, and local decisionmakers in targeting resources for training programs. Forecasts are also helpful to the public who can use them in selecting occupations to pursue.

Substantial Federal, State, and local training funds are involved. Education and training programs represent close to a $200 billion industry in this country. Until recently, the Federal Government spent over $30 billion yearly in higher education and skill training programs. Disseminating labor market information can help improve the effectiveness of these substantial funds. This figure alone indicates the necessity for establishing funding priorities in some rational manner. Labor market planning can be very helpful here as well.

Given the imprecision of labor market forecasting, coupled with the fact that the Government does intervene to change the supply and demand for labor, the importance of evaluating the impact of these programs becomes paramount. The Federal Government performs extensive labor market research and program evaluation through several agencies already, but many significant questions remain unanswered. The following are just a few:

Are training programs producing the skills most needed or are they merely displacing other workers?

Are training programs producing skills for occupations with high turnover rates?

Do training programs result in income gains?

Are analytical techniques adequate?

Do major Government programs siphon off scarce skills from private industry?

What is the impact of the Government-industry competition for skills on national productivity and price competition of American goods?

In summary, labor market planning is far from perfect, but it is still essential. We need much more and better information about labor supply and demand. Analytical techniques that might offer greater accuracy also cost more, so that appropriate tradeoffs must be considered.

Economic assumptions also present a problem. The accuracy of our forecasting depends heavily on such economic assumptions as unemployment, inflation, and productivity growth. Thus, realistic assumptions must be made to give us a better definition of the problems we are trying to solve. At the same time, we need to better understand labor supply and demand interrelationships within these macroeconomic factors. Much more research will be needed in these areas as well.

The Nation is undergoing many changes simultaneously that make labor planning even more difficult. For example:

Historically high unemployment, coupled with serious skill shortages.

Population explosions in the South and West and industry shifts in these areas.

More women but fewer teenagers entering the work force.

All of these changes, coupled with the technological advances that are being driven by our competitive market practices, increase the importance of reliable labor market information. This morning I have tried to demonstrate that importance. I have also identified a number of problems that we will have to overcome if we are going to improve the accuracy of such labor market forecasting. However, as I pointed out earlier, the cost of better accuracy may well be disproportionately higher than the benefits gained. The next logical step, therefore, is to decide which data problems we want to solve and then assess the related cost and benefits.

This concludes my prepared statement, Mr. Chairman. We would be glad to respond to any questions the subcommittee may have.

Mr. Gore. Thank you very much.

[The prepared statement of Brian Usilaner follows:]

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WASHINGTON, D. C. 20548

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STATEMENT OF

BRIAN L. USILANER
ASSOCIATE DIRECTOR

ACCOUNTING AND FINANCIAL MANAGEMENT DIVISION
NATIONAL PRODUCTIVITY GROUP

BEFORE THE

SUBCOMMITTEE ON INVESTIGATIONS
AND OVERSIGHT

COMMITTEE ON SCIENCE AND TECHNOLOGY

ON

"AUTOMATION IN THE WORKPLACE, ITS IMPACT
ON THE LABOR FORCE, AND THE ROLE
OF LABOR MARKET PLANNING FOR POLICYMAKING"

Mr. Chairman and members of the Subcommittee, thank you for this opportunity to discuss automation in the workplace and its impact on the labor force. It is clear the Subcommittee has particular concerns about our ability to forecast the impact of automation on such labor problems as worker displacement, skills shortages, and geographic dislocations. Forecasts are an essential tool in developing Government policies and programs for education, technical training, and retraining to remedy these problems. If we fail to understand how our labor markets function, consequent policies and supporting programs could at best be ineffective, or at worst exacerbate the very problems we are trying to correct. Unfortunately, understanding labor markets in a nation as complex as ours is not easy.

In my statement today, based on GAO's past and ongoing work, I will focus on:

--The importance of automation to productivity and the economy,

Barriers and stimulators to the rapid diffusion and use of automation,

--The potential impact of automation on the work force, and

--The difficulties of labor market planning.

IMPORTANCE OF AUTOMATION TO PRODUCTIVITY AND THE ECONOMY

A key factor in productivity and economic competitiveness is automation. Our nation's lag in implementing automation when compared with other industrial nations is reflected in part by our declining productivity and international market performance.

Americans have become deeply concerned about the productivity and competitiveness of our manufacturing industries. They recognize that imports now pervade our marketplace, once the almost exclusive province of American manufacturers. Yet, the profusion of foreign-made automobiles, calculators, refrigerators, and cameras, are only the most visible signs of this foreign penetration. What is particularly ominous is the prospect that further losses in the producer goods market--such as machine tools, robots, computers, and integrated circuits--could signal, in the not too distant future, an over reliance on foreign producers for automation systems and components which are now the lifeblood of our manufacturing base, and especially, our defense industrial base.

One way American manufacturers could potentially raise productivity and product quality significantly is by coupling families of manufacturing technologies into integrated, flexible systems. If the use of these systems were to then spread quickly throughout our industrial base, in both producer and consumer goods, we could once again become competitive. The Japanese have made significant strides in this area. "Integration" is the key to ultimate success here because traditional organizational and operating structures of the manufacturing firm would be completely changed. There are roughly 400,000 manufacturing establishments in America that could benefit by adopting integrated manufacturing systems.

Because widespread use of automation technology would help us competitively, automation is a desirable economic goal. Unfortunately, however, automation is a double edged sword, for while it can help our competitiveness, it can also hasten and exacerbate our employment problems. Still, we must be realistic in our expectations of how rapidly and how effectively these sophisticated systems are likely to be put into place, and, based on these judgments, what the impact will be on the work force.

BARRIERS AND STIMULATORS OF AUTOMATION

Today, serious impediments exist in this country in the development and integration of automation technology. These impediments directly affect the rate of technology diffusion and the effectiveness of automation systems; in turn, they will moderate or exacerbate automation's impact on the work force. In general, the impediments fall into four categories--technical, financial, organizational, and social.

Technological impediments center around the incompatibility of the machinery and programs, usually referred to as the hardware and software. Until compatibility is achieved, the many diverse components cannot be integrated into efficient manufacturing processes. The present dearth of engineering talent working on these technological impediments suggests that fully integrated systems are still well off into the future.

Moreover, current market practices by component makers tend to discourage integration. These manufacturers often make their components unique rather than compatible in order to gain an assured market niche. Such actions, of course, delay rather than foster the standardization of automated systems.

Meanwhile, the roughly 400,000 manufacturing firms that could benefit from integrated systems are being provided only components--robots, numerically controlled machine tools, microprocessers, computer-aided design--not systems. Integration, if done at all, must be done by the users who typically lack the engineering talent to design and integrate their own systems.

Consequently, the quantum productivity improvements expected from integrated systems are not now taking place. Instead, firms are making incremental improvements, but none that would ensure long-term productivity improvement.

Financial and market barriers are those which discourage investment in automated devices, such as

--high interest rates,

--the tendency of businesses to focus on short-term needs,

--uncertainty of the marketplace, and

--other capital investment considerations such as cash flow cost recovery, and the risks inherent in new, untried equipment.

The investment objective of many companies is to recoup the cost of equipment in less than 3 years--much too short a time frame to adequately assess long term benefits of automation. In addition, well designed, integrated systems involve major investments of capital which may be beyond the realistic hope of most small and medium size firms. Their cash flow positions, which are crucial in the decision to invest, simply cannot sustain these extraordinary investments. Moreover, rapid technological change may render these systems obsolete in relatively short periods of time. In times of such great market uncertainty, these small and medium firms thus face the prospect of never being able to recover the cost of the systems.

We use the term organizational barriers to distinguish between today's tradition-bound manufacturing organization and tomorrow's factory of the future. Today we see tightly compartmentalized departments for designing, manufacturing, marketing, purchasing, distributing, accounting, and all the other functional operations. Fully integrated automated systems, on the other hand, means that the organization itself will be integrated, eliminating several tiers of the traditional structure, and streamlining the middle management and overhead areas in particular. Generally speaking, current manufacturing firm managements do not yet view automation in this light, and there are few, if any, models for them to emulate.

Finally, the social barriers are based on human resistance to change. For example, a union may be apprehensive about the impact of automation on its members and may attempt to protect them through restrictive labor-management contract clauses. Even top managers themselves may be apprehensive about using new equipment or of installing new systems because of the changes that might follow. Initial consumer resistance to automatic checkouts at supermarkets and to electronic funds transfers demonstrates our basic mistrust of automation. But, these examples also demonstrate that through persistence, human resistance can be overcome and technological advances continue.

Despite these barriers to automation, however, the magnitude of our national economic problems--rising labor costs, decreasing competitiveness, shrinking market shares--is forcing us to turn to technology as a way of regaining productivity and market share. These conditions will likely continue to stimulate both development and use of automation technology.

POTENTIAL IMPACT ON THE WORK FORCE

But what is the potential impact of this automation on the work force? To assess this we must address two questions which I alluded to earlier: (1) how rapidly will automation spread? and (2) how sophisticated and integrated will these automated systems be? Slow, incremental installation of individual components, such as robots and numerical control equipment, will probably moderate any employment impact. On the other hand, sophisticated, fully integrated systems may radically change the employment picture. However, because these integrated systems are very expensive and the talent needed to design, install, operate, and service them is scarce, it is unlikely we will feel severe impact on the labor force for some time.

Thus, available evidence suggests that the impact of automation may be more gradual than popular opinion might suspect. In manufacturing, for example, if fully integrated systems were installed in, say, 10,000 enterprises per year--which would seem to be a very ambitious undertaking--it would still take 40 years to automate our total industrial base.

The concern over whether automation will cause high unemployment is not new. In 1964, the Congress established the National Commission on Technology, Automation, and Economic Progress. One of the main reasons for its establishment was concern over the possible employment impact of computers. The Commission concluded in 1966, that automation would not cause severe unemployment over the next 10 years. We can now all attest to the fact that it did not.

Presently we are witnessing renewed concern because of the expanded uses of automation in virtually all sectors of the economy--uses made possible through microelectronics. Microelectronics has made automation more usable as the computers have become smaller, less costly, and easier to use. One observer predicts that 40 to 50 percent of all American workers will be using electronic terminals by 1990.

The extent of long term worker displacement caused by automation is the subject of much current debate. There is, however, wide agreement that some short-term displacement and skill shifts are already occurring and will continue to do so. For example, typesetting has become a declining occupation, computer-aided design technology is eliminating the occupation of drafter, and robots are replacing welders, painters and some assemblers in automobile plants.

The key issues for policymakers and, therefore, for forecasters, are (1) whether automation's impact will have the effect of causing long-term structural unemployment and (2) whether shifts in skills for most workers will create higher or lower skill demands. The accuracy of these judgments will largely determine how effective government policies for education, training, and retraining will be.

There is a widespread belief that high technology will require workers to have more sophisticated job skills; therefore, we should upgrade math and science education in our nation's schools. This belief is based on the assumption that first, future job growth will favor professional and technical level jobs--engineers and computer programmers, for example--that require considerable education and sophisticated training. Second, high technology will upgrade the skill requirements of existing jobs because workers in those jobs will work increasingly with technologically sophisticated equipment. And, indeed, job forecasts for the period 1978 through 1990 indicate that the fastest growing job categories include several high technology occupations--data processing machine mechanics, paralegals, computer systems analysts, computer operators, and office machine and cash register servicers. Based on these forecasts, there is ample reason for policymakers to be concerned about our educational system.

On the other hand, we must also be concerned about another important factor in these forecasts--that is, the total numbers of workers affected as opposed to rates of occupation growth. For example, while the five high technology occupations I just mentioned are forecasted to produce 518,000 new jobs by 1990, five low skilled occupations are expected to increase by about 3 million jobs. These occupations include janitors, nurses aides and orderlies, sales clerks, cashiers, and waiters and waitresses--occupations requiring no more than a high school education.

Thus, the growth in new high technology occupations may not have a major impact on total employment numbers. Still, high technology will probably have a profound impact on many existing jobs in the economy. Secretaries will work with computerized word processing equipment; bookkeepers will use computerized, financial spread sheets; clerks in purchasing and inventory will apply their skills to automated and computerized record systems; mechanics will use diagnostic equipment tied to mini-computers; and telephone operators will rely on computerized directories. But will these kinds of changes require workers with more sophisticated skills, beyond the initial learning period? This remains a subject of considerable debate.

DIFFICULTIES IN ACCURATE LABOR MARKET PLANNING

Understanding how these changes might come about and the problems they might create is extremely important in labor market planning. Government labor market planning entails identifying potential imbalances in labor supply and demand, publishing that information, and encouraging workers to train for occupations where there are shortages. Generally, planning requires:

--Obtaining information on the labor market (by occupation) and any trends affecting the supply and demand for labor. This includes basic research into how the labor market functions.

--Developing methodologies to forecast supply and demand and then making forecasts.

--Disseminating forecast results to potential users and encouraging their use by education and training agencies in setting up programs.

--Evaluating the impacts of Federal programs on the labor market to improve existing programs or suggest new ones.

Each of these criteria is far too complex to discuss at any length here. But, let me give a brief overview of each, and point out some of the problems relating to them.

Obtaining information about the labor market

Labor market planning requires comprehensive occupational data on national, state and regional levels about both labor supply and demand. One problem in labor forecasting is that relevant supply information is often missing. For example, no centralized single data base is available consolidating information on all current graduates seeking work in a specific occupation. Potential supply of available workers is generally more than the numbers specified in existing data bases. Further, detailed supply information by skill or experience level is virtually nonexistent. In estimating labor supply, one should also examine the substitution or transference of one supply source for another--that is the shifting of workers from one occupation to another.

Current occupational supply is defined as that portion of the labor force attached to a particular occupation and consists of currently employed individuals and the unemployed. When labor forecasts include estimates of labor supply, they generally consider only the current occupational supply. The potential supply--the total number of workers qualified to be in a particular occupation--is not considered. These individuals may be employed in a different occupation, unemployed and seeking work in a different occupation, or not currently in the labor force. More work is needed to better determine how to measure potential labor supply.

Several federally funded education and training programs, in addition to local government and private institutions, affect labor supply. Determining the net addition to labor supply is difficult. For example, CETA, vocational education, and private schools have all trained individuals for the same occupations. In 19 occupations that we examined, these training activities did not routinely provide the training information for forecasting purposes. Thus, each activity could have been contributing to a surplus of workers in a particular occupation and labor market.

Occupational demand, on the other hand, is easier to estimate than labor supply, especially in the short term. Still, errors are made here as well. Since demand estimates must be made by skill level and region, comprehensive surveys of current job openings or vacancies can give a good starting place for forecasting current labor demand. But, as with supply, it is important to break down demand by skill level and experience. For example, a study of high demand occupations in Massachusetts 1/ found that when many employers spoke of occupational shortages, they were referring to the quality of employees rather than an insufficient number of workers in the occupation. This

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1/ "An Analysis of Selected High Demand Occupations: Findings From a Statewide Survey," Massachusetts Executive Office of Economic Affairs, October 1980.

is just one indication where reliable labor market information needed for forecasting and policymaking is not readily available today.

Methodologies to forecast supply and demand

Occupational forecast accuracy depends on the reliability of input data and modeling techniques used. If the data and techniques used are incorrect, forecast errors are to be expected. People using incorrect information may enter a surplus occupation, or they may not train for a shortage occupation. Such factors affecting input data may include, though not be limited to, overly optimistic assumptions in economic forecasts, inadequate labor supply and demand information, lack of knowledge about the interaction of labor supply and demand, and external factors, such as rapid technological change, that disrupt the economy. Aggravating all these input data problems is that the information must be broken down to the State and sometimes local labor markets.

Modeling techniques such as trend extrapolation, employer surveys, econometric models, input-output analysis, or combinations of these have their own strengths and weaknesses. For example, employer trend surveys are inexpensive, but historically unreliable for predicting specific occupations into the future. Econometric models are more accurate but are very expensive since they require large data bases. Cost versus accuracy trade-offs must be made in choosing the technique. Unfortunately, little information is available to the forecaster on which model to use. And because of the dynamic nature of our economic system, there can be no guarantee of accuracy, no matter which technique is used.

Disseminating Forecast Results And Encouraging The Use Of Forecast Information

Despite the errors that occur, labor market forecasts are indicators of future skill needs, at least on a national basis. While not the sole consideration in the decision making process, forecasts aid national, state and local decisionmakers in targeting resources for training programs. No decisionmaker wants to waste resources in training people for occupations which already have a surplus of qualified workers. Forecasts are also helpful to the public who can use them in selecting occupations to pursue.

Substantial Federal, State and local training funds are involved. Education and training programs represent close to a $200 billion industry in this country. Until recently, the Federal Government spent over $30 billion yearly on higher education and skill training programs. Disseminating labor market information can help improve the effectiveness of these substantial funds. This figure alone indicates the necessity for establishing funding priorities in some rational manner. Labor market planning can be helpful here as well.

Evaluating Federal Programs That Affect the Labor Market

Given the imprecision of labor market forecasting, coupled with the fact that the government does intervene to change the supply and demand for labor, the importance of evaluating the impact of these programs becomes paramount. The Federal

Government performs extensive labor market research and program evaluation through several agencies. While such research and evaluation efforts provide decisionmakers and program managers with important information, many significant questions remain unanswered. The following are just a few examples:

--Are training programs producing the most needed skills, or are they merely displacing other workers? And what becomes of those displaced workers?

--Are training programs producing skills for occupations with high turnover rates. If so, do high turnover rates mean that training programs were inappropriate?

--Do training programs result in income gains? If not, are the programs achieving their intended objectives?

--Are analytical techniques adequate to make sound forecasts and comparisons of the effects of training programs?

--Do major Government programs siphon off scare skills from private industry?

--What is the impact of Government-industry competition for skills on national productivity and price competitiveness of American goods?

In summary, labor market planning is far from perfect, but it is still essential. We need much more and better information about labor supply and demand, particularly as we move toward an era of greater automation. Analytical techniques that might offer greater accuracy also cost more, so that appropriate trade-offs are necessary.

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The accuracy of our forecasting depends heavily on economic assumptions--such as unemployment, inflation, and productivity growth. Even modest misjudgements about economic performance can cause large errors in labor market forecasts--for example a 1 percent underestimation of employment, means 1 million more people will be out of work than originally predicted. Thus, realistic assumptions must be made about the economy to give us a better definition of the problems we're trying to solve. At the same time, we need to better understand labor supply and demand interrelationships within these macro economic factors. Much more research will be needed in these areas.

The Nation is undergoing many changes simultaneously that make labor planning even more difficult. For example:

(1) At the time of historically high unemployment, serious skill shortages persist. This paradox does not speak well for our ability to either predict skill shortages, or to remedy imbalances through appropriate policy or program responses.

(2) Geographically, we have seen virtual population explosions in the south and west where many industries have relocated or started. Such major shifts raise questions about government's appropriate response --should training be set up for workers in declining areas in hopes that industry will return, or should policies encourage workers to move with industry. Workers seem quite willing to change jobs, but not to leave their home communities.

(3) Demographically, more women, but fewer teenagers are entering the work force, at once both increasing and decreasing the need for entry level training.

All of these changes, coupled with the technological advances that are being driven by competitive market pressures, increase the importance of reliable labor market information. Today, I have tried to demonstrate that importance. I have also identified a number of problems that will have to be overcome if we are to improve the accuracy of labor market forecasting. However, as I pointed out earlier, the cost of better accuracy may well be disproportionately higher than the benefits gained. The next logical step, therefore, is to decide which data problems we want to solve and then assess the related costs and benefits.

Mr. GORE. Mr. Helms, do you consider the occupational outlook reports prepared by the Bureau of Labor Statistics to be job forecasts?

Mr. HELMS. No; there is a technicality here. It presumes to forecast jobs. Now we are doing—my firm is doing—occupational forecasting within an occupational field that maybe subsumed tens or hundreds of jobs.

Coming back on the other side of that question, as I pointed out here, the job statistics, the employment demand statistics, are developed on the basis of surveys conducted by the Department of Commerce's current population survey unit. Now the survey units collect employment and unemployment information by calling samples of households to learn whether the head of the household or previously reported workers are employed. This is done by telephone, and they use a printed questionnaire. I have looked at the questionnaire. It is rather obscure, ambiguous, and the staff I have worked with admits that it presents opportunities for substantial errors.

Taking this data, as questionable as it may be, and then relating it to a "400 groups of occupations," and using that information to try to forecast job demand in the Occupational Outlook Handbook for occupations in the DOT just does not fit together. You have entirely different categories of occupations, and the staffs have admitted, and the Presidential commissions and others have found, that they cannot correlate the data used by the current population survey unit with the occupations in the DOT, which occupations are used in the Occupational Outlook Handbook, with the statistics derived from the current population survey.

Therefore, I say that the Occupational Outlook Handbook should be evaluated, investigated. There are no new occupations in there.

It is published every 2 years. If the occupations in the Dictionary of Occupational Titles are obsolete, then the occupations in the Occupational Outlook Handbook are not up to date and not forecasting new occupations in the new high tech industries.

Mr. **Gore**. Therefore, they are not job forecasts?

Mr. **Helms**. No, sir.

Mr. **Gore**. They are imperfect snapshots——

Mr. **Helms**. Right.

Mr. **Gore** [continuing]. Of the current period of time, and fail to take into account dramatic new growth areas, and they fail to discount areas of employment that are threatened with obsolescence?

Mr. **Helms**. Positively.

Mr. **Gore**. Does one of you want to comment on that? Mr. Fritts or——

Mr. **Fritts**. I think Mr. Solenberger has worked more in this area.

Mr. **Gore**. Yes; Mr. Solenberger.

Mr. **Solenberger**. The occupational forecasts are published for what they call high growth occupations, not jobs. The purpose of the handbook, at least my understanding, is in large part to provide students with information on where future jobs are and where to possibly train.

In many cases these expanding jobs that are several years into the future may not materialize, and there may be no training opportunities available.

Mr. **Gore**. Mr. Usilaner, in what areas do you think the Bureau of Labor Statistics does a good job in predicting occupational changes over time? In what areas do you think they do a poor job, especially with regard to the impact of new technology?

Mr. Solenberger.

Mr. **Solenberger**. The BLS has very little capability to precisely forecast jobs anticipated over, let's say, the next decade or two decades. Their analysis is primarily of historical trends.

In making forecasts for new occupations or new jobs where we have very little historical information, the accuracy tends to be quite low.

In comparing BLS forecasts to other forecasting techniques, the smaller the occupation we are dealing with, the greater the error rate. It is sort of a no-win situation the smaller the occupation you get to.

I think that is probably the fairest way to put it from the standpoint of BLS versus some of the other forecasts. Comparisons have been made. In some cases they have turned out to be comparable, and in others there have been significant differences.

Mr. **Gore**. Congressman Wright referred to the statutory mandates earlier. "The Secretary of Labor shall establish and carry out a nationwide computerized job bank and matching program using electronic data processing and telecommunication systems to the maximum extent possible," et cetera, et cetera.

Mr. Usilaner, in your GAO review, did you determine why BLS has failed to carry out this statutory mandate?

Mr. **Usilaner**. No, we did not cover that.

Dave, do you want to mention some of the critiques of the system?

There will be a report out soon on that. We have not finished a complete review of that.

Mr. **Gore**. Mr. Solenberger, do you know why they didn't do it?

Mr. **Solenberger**. I have some comments on some issues that would have to be addressed.

I think the specifics of why they did or did not do it might be best left to them.

Mr. **Gore**. We will ask them, the next panel.

Mr. **Solenberger**. I have some observations or comments which will be presented in a much more detailed manner in our report that we hope to issue within the next month.

When the issue of a national jobs data bank is addressed, some of the issues that must be considered are the capabilities of the States' existing computer systems to provide real time information on current job openings. Another issue that would have to be addressed in any type of national system would be the reliability of the input data. When I talk about input data, I am talking of two types.

First, the employer has the responsibility to notify the jobs service at the State level of any prospective job openings.

The participation on the part of employers will vary depending, for example, on the skill level of the occupation. Generally, when you get into the high tech area or the white collar area which is often considered the higher income-type jobs, employer participation in the jobs service program is not as high as in low skill, low-paying jobs. Obviously, it will vary between States and regions.

The second reliability problem for the input data is whether the employment service—and these are generally State organizations—has a reliable data base.

There are existing data bases which in some cases, operate on a real time basis while others are slower. For example, you have delays in inputting information on job openings and, for that matter, on closings—notifying all those people who received the job information that the job is now closed. When this happens, an employer who may anticipate interviewing only, let's say, a limited number of people, may get literally hundreds of requests, and these requests could go on long past when he has made his selection.

Another issue that would have to be addressed is the cost of the service and who is going to pay for it. Generally, the employment insurance program is run on a trust fund basis. That would mean funding by employers as opposed to general tax revenues.

Another issue that would have to be addressed is the types of jobs in terms of skills, experience, and wages that you want the system to handle. For example, as a general rule, we have local labor markets, not national in scope.

The best type of jobs that would be served by a national jobs data bank might be the higher income, more specialized varieties. These are the jobs that are generally not handled by the current employment service system.

Then you must address the willingness of people to relocate. Finally, an issue that is quite relevant to a data bank that forecasts into the future—for example, the next 6 months or a longer time frame—is the analytical methodology you want to incorporate into your data base. Once you go from current job openings to forecasting future opening, you get involved in alternative methodologies.

There was an effort on the part of the Department of Labor to establish a national job bank test project. It is currently located in Albany, N.Y. It involves a computerized, online network with at least 6 States participating.

We would suggest that in any decision to expand or establish a national jobs data bank this existing effort be fully evaluated.

Mr. **Gore**. Mr. Helms, you wanted to comment?

Mr. **Helms**. Yes. I think there are two aspects to the question. One, the technology to do this obviously is readily available, but in my comments here I tried to point out that with so many differing data bases, so many differing dictionaries, and so many different systems all trying to interrelate, the statistics are highly questionable. The art of defining the occupations seems to be in conflict from the Department of Commerce or the Department of Education or the Department of Labor. The staffs in all three of these departments agree that their occupational definitions do not agree with those of the others.

Therefore, it is like I mentioned in my initial comments, when I briefed some staff of the Joint Economic Committee with a flowchart diagraming the flows of this information, some of the staff of the JEC remarked to me, "garbage in, garbage out." That is a very critical situation today when we have so many people unemployed and they are trying to transition from the occupations of the industrial revolution era, which is now past, into the occupations of the new high tech era.

On the one hand, we have obsolete and obsolescent occupations for the industrial revolution era, but no one is forecasting and creating the new occupations in our high tech industries. I cannot think of a statement that is more profound than that. I am very much concerned about it.

What we need is a national project to identify, to assess the new technologies, and to identify the needs in these new technologies for new types of occupations. As I stated here, the Department of Labor staff has advised me they have never created a new occupation; they do not know how to create a new occupation; they are not sure they have the statutory authority to do this. Now where do we go from here?

The past is here today, and the future is here. However, all we can see is the past. We cannot see the occupations of the future. I cannot think of anything that is more critical and more urgent today—and I sat in this conference all morning and listened to the discussions and listened attentively—it seems to me that most of the points made are: what are the new occupations? Where are the new jobs? How are we going to educate and train people for the new occupations?

How can we do this if we do not know what the new occupations are? We are not going to know until we set up some type of comprehensive project that would get into technology assessment—take it from technology assessment and forecasting. Let's start there, and let's start looking at these new technologies. Let's bring some industrial engineers in and some occupational analysts and work with industry to find out where they have needs for people with new skills and knowledges, and where there is in the robotic plants, in the genetic engineering process laboratories, or in the photonics telecommunication systems, or wherever, wherever the technology is—these are new sunrise occupations, industries that are sunrise occupations. However, nobody is identifying them.

It is just as important in the Occupational Outlook Handbook or by any other means that we identify the obsolescent occupations so we do not continue to perpetuate education and training programs to produce well educated and trained people for occupations for which today we have experts walking the unemployment lines in Detroit and other cities.

If we do not do something quickly, the billions of dollars which you presumably will appropriate, or have appropriated, for the Job Training Partnership Act is going to be used to set up the same kind of training programs to train people in these obsolete occupations, occupations for which today we have unemployed experts lined up in the employment queues.

Mr. GORE. Congressman Durbin.

Mr. DURBIN. Mr. Helms, can you give us any specific examples of obsolete jobs that are still being reported in the Bureau of Labor Statistics model?

Mr. HELMS. Well, there was discussion this morning about keypunchers, and so forth, the printing, the lithographic trades, and so forth.

I have looked, for example, at the apprenticeships which have been approved by the Bureau of Apprenticeship and Training. There are about 700 apprentice programs listed there, in excess of 700. Not one of those 700 occupations is current. There is not an occupation listed in the apprenticeship training programs that has not existed for decades.

Mr. DURBIN. Are we playing with titles here? Are we dealing with maintenance engineers and data input entry operators as opposed to janitors and typists? Is it more than just titles we are talking about?

Mr. HELMS. No. The titles that we have, of course, relate to an apprentice program. Now the actual skills, the training, the knowledge, the job skills laid out in some of these training programs are for occupations that no longer exist.

As I mentioned in my printed testimony there, as a former director of the Navy's apprentice training program, which was the biggest apprentice training program in the country, probably in history, my biggest concern, my biggest difficulty was to go out to the shipyards and the repair facilities and the depots and to inspect those apprentice training programs and be sure they were current, that they were updated abreast of the advancing DOD technologies.

Now the people in the Bureau of Apprenticeship and Training over in the Department of Labor tell me—I think they have—how many apprentice supervisors do they have?

Anyway, they have about 300,000 apprentices, and I think a thousand apprentice programs. They have, I believe they said, only 200 field inspectors to go out and insure that these apprentice programs are up to date.

Let me also mention that these apprentice programs for the most part are the sources from which union members are recruited. We have recognized extensively in the media and other areas that many of the union members, union workers' jobs, are gone, but these people, as Dr. Cetron pointed out, the average age is 54. These union members completed their apprenticeship in the immediate post-World War II period, and they have not gone back to school.

Now I submit that inasmuch as this committee is concerned with investigations and oversight that here is an area that should be looked at. As others have pointed out, much of the training today must be done—most of it must be done—in the private sector by private industry. That is the only place you have the robots. That is the only place you have the computer-assisted manufacturing plants, the flexible manufacturing systems, and so forth. The high technology is there.

Apprentice training is an employer-oriented, on-the-job training program. If our apprentice training programs are not up to date, are not current, and if we are not forecasting and creating new apprenticeships, and we are not, then I say there is a valuable tool that is not being exploited in a time of great criticality for this Nation. We should do something about it.

Mr. DURBIN. Mr. Solenberger, I would like to go back to the question asked by the chairman earlier. I got a mixed signal from you about a nationwide jobs bank. Did you intend to create one?

I started off hearing that it was something that was not practical and there were a lot of problems. Then I heard at the end of your statement—and either you have been exposed to lawyers or have some legal training—by the end of your statement you suggested there was a model we might try to pattern ourselves after.

Mr. SOLENBERGER. It has been tried before. The results or an evaluation of whether that was successful have not really been made yet. The results are not in yet on that.

There are a lot of issues that have to be addressed in the creation of any sophisticated data base. Obviously, it is a policy decision as to whether you want to do that or not.

There is another level with which I am more familiar, and that is implementation. There are several steps in the implementation stage that we have to be sure work.

Mr. DURBIN. Have we created an impossible goal here with the passage of this legislation calling for a national jobs bank where we want to hold the Department accountable for not having done it? Are you telling us, frankly, that it could not be done?

Mr. Fritts. Dave, let me try my hand at this.

The thing that is very important is that technologically—as has been pointed out—it is technologically doable today. However, we have to be very practical from the conceptual standpoint.

What is it you really want to do with a jobs bank? Then, within the context of what you think you want to do, what is the practical, real world like?

The employment services throughout the United States basically deal with people at a low-skill level. They are trying to place people in low-skill jobs. These are people who do not move. You do not move, for example, from Washington, D.C., to Texas for $3.65 an hour.

So if this is the real job market for the data bank that you are going to create, then is it realistic to create a national one? What are we trying to do with it? It may not be realistic from the standpoint of the skill levels actually being served by the current system.

Mr. **Durbin**. Mr. Fritts, excuse me a second.

Mr. **Fritts**. Yes.

Mr. **Durbin**. Is it your understanding that that is what Congress is looking for in the Job Training Partnership Act, some exchange of information at that level of employment?

Mr. **Fritts**. No. What I am saying is that from the practical standpoint of today's labor market, the employment service offices have been traditionally serving low-skill jobs—people that are being placed and are seeking jobs, and those are the kinds of job offerings that are being made through the employment services—basically, the low-skill jobs.

If there are ways to create a job bank concept in which we serve the white-collar jobs as well, and we get more confidence built up, a national jobs bank concept begins to make more sense. One of the problems, I understand, is that white-collar employers do not wish to use that kind of service because they do not expect to get high quality people through it; simultaneously, those who are the white-collar people who are looking for jobs would not look for a white-collar job through the service because they think the service places only low-skill people.

Mr. **Durbin**. However, if it were available—let's say you were an employer looking for a white-collar applicant for a specific skill and you assumed that in your small community that person was not available and your alternative was to go to some national trade journal, for example, and run an ad or, in the alternative, put input into this nationwide job bank——

Mr. **Fritts**. Then it begins to make more sense, because what you have just done is to break out your criteria for the system by skill level.

Mr. **Durbin**. However, that could still be accomplished.

Mr. **Fritts**. Yes.

Mr. **Durbin**. We are not talking about something that is beyond the capability of man.

Mr. **Fritts**. No. Technologically, it is quite doable. There is no question about that. It is doable on a real-time basis.

Another consideration you have is how much this is going to cost. You cannot simply go out and do it. You have to decide what it is you want to do, how you want to do it, and then how much it is going to cost, and what we are going to get from it.

Mr. **Gore**. Will my colleague yield?

Mr. **Durbin**. Certainly.

Mr. **Gore**. The leadoff witness in tomorrow's hearing has done a careful study of this project and has a specific recommended strategy and a dollar estimate of exactly what it would cost. This is Pat Choate of TRW.

However, what you are telling us is that, from your point of view, it is feasible; it could be done; it depends on how much you want to spend to do it.

Mr. **Fritts**. It also depends on whether you think you are approaching the right kinds of objectives.

Mr. **Gore**. Yes.

Mr. **Fritts**. Again, the low-skill person is not going to move from here to Texas for a $3.65-an-hour job. That is just not practical.

You do not develop a nationwide system to do that, but if you raise the skill levels through which you are passing information, then it becomes more and more nationalized.

Mr. **Gore**. Isn't it fair to assume that—if my colleague will continue to yield briefly—isn't it fair to assume that a much better short-term projection of the kind we could get from a nationwide, computerized job bank would necessarily lead to a quantum improvement in our ability to project into the longer term? Isn't that a reasonable assumption?

Mr. **Fritts**. Yes. I think it is very reasonable.

Mr. **Gore**. Then the benefits that we would get from a strategic perspective, the benefits accruing to the Nation from a dramatic improvement in the accuracy of those short-term projections, would not be reflected merely in the increased access to job data on the part of those who are looking for jobs immediately. The value, if it were accurately calculated, would have to take into account the improved strategic vision of the Nation in looking down the road at what is happening to occupations that are in the sunrise category or in the sunset category, and so forth.

Mr. **Fritts**. That is the kind of thing that Mr. Helms has been talking about.

My only point is that, unless we look at what we now have, and the way we want to do it differently, one of the things you are going to find, for example—and I think Dave Solenberger alluded to this—if you are going to use the current structure, the current employment service offices have to be upgraded. Those offices have people who will have to be upgraded, too, in their ability to input information very quickly, whether it is to operate a terminal—and presumably it would have to be through a terminal, on an online, real-time basis. They would have to be trained to do that accurately and quickly. In addition, the system would have to be designed in a very efficient way, so that you are using information that is accurate. If somebody gets a job, you want that piece of information out of the system, and so on and so forth. A good systems design job is one of the key beginning points.

Mr. **Gore**. If my colleague will indulge me for another question, in the political profession techniques of sampling are well known in the form of political polling, but the basic principles involved there, it seems to me, might also be applied here.

Has anyone proposed a scientifically accurate sampling of want ads in locations around the country, to extrude from that sample a more accurate picture of what the mix of jobs and applicants might be?

Mr. **Fritts**. My understanding is—and, Dave, you can correct me—that the BLS uses that technique now to varying degrees.

Mr. **Gore**. To varying degrees?

Mr. **Fritts**. Yes. I am not sure exactly how it is used.

Dave, do you want to comment?

Mr. **Solenberger**. There are several different forecasting methodologies. Obviously, want ads are considered. The one that BLS uses for its long-term projections—and that is basically what we are talking about when we go to the occupational forecasts—is a fairly simple linear extrapolation or projection of historic trends adjusted.

The technique that we are getting fairly close to here is called an employer survey technique. This used to be used by the private industry councils and then some of the CETA prime sponsors to get local forecasts, because in many cases we did not have accurate local forecasts for the agencies that needed them in skills training programs.

Employer surveys can in many cases be relatively inaccurate, especially if you try to forecast out far enough to develop a skills training program, because you are talking, then, about 1 to 2 years to get a skills training program into operation.

Employers have a tough time forecasting that far into the future.

Mr. **Helms**. The conference board, well known, of course, as was mentioned on the NBC white paper, "America Works When America Works," and you may have seen it, does this type of newspaper information sampling and collecting. I feel that if they can do this and do a good job, then we should be able to do it with the moneys available in the Federal Government.

I also feel that this breakdown in this area of occupational information might be found to be one of the major causes for what we call structured unemployment. To the extent that structured unemployment means that we cannot match unemployed people with jobs that are out there, here is the genesis of it. The information system in the cities, in the States, and in the Federal Government, does not provide this information in an adequate and accurate and timely manner. It is not available, particularly for the new high tech industries.

We have high tech industries now. The corporations in these are begging and competing. As the NBC white paper "America Works When America Works" showed, some of the Silicone Valley corporations out there are giving employees all types of perks, many of which some of the people here in the Congress would like to enjoy, I suppose, to get them to come to work. They cannot keep them on the job, because as soon as they get them employed, someone else upstages them, and they go somewhere else.

There is an imperative need to create these new high tech occupations, these new sunset occupations, and get competent people in these occupations as fast as possible.

The Congess has passed legislation authorizing billions of dollars in tax concessions, to build our new high tech industry corporations. Now, it does not make sense to put so much money into building these corporations, and not being able to find people qualified to do the work, in a productive manner, and we are 10 to 15 years behind the power curve in setting up the training programs, and getting instructors qualified to teach, and getting textbooks that reflect the new high technology, and getting the equipment in the schools, needed to teach the new high technology, and finally, coming out of the pipeline with qualified workers.

For this period of time, these new high tech corporations in which we have invested billions of dollars, will be compromising their technology capabilities by having to employ people under the old metalsmith, welder, and sheet metal worker and foundry trades, and paying them at wages which have been negotiated over decades for work they are not qualified to do, and for work they are not interested in going back to school to learn to do. Now, this is a critical situation. I cannot think of anything, in my respectful opinion, that is more needed for some type of investigation and facts. If we do not get the facts, then how do we get the navigation, an instrument to know where we are going?

Mr. GORE. Thank you, Mr. Helms.

Congressman Durbin.

Mr. DURBIN. I have nothing further, Mr. Chairman.

Mr. GORE. Let me thank each member of this panel. I really appreciate your testimony. It has been an invaluable contribution to the effort in which we are engaged. Thank you all very much.

Our final witness is Ronald Kutscher, Assistant Commissioner at the Bureau of Labor Statistics in the U.S. Department of Labor.

We would like to welcome you here.

You are accompanied by whom?

Mr. KUTSCHER. By Neal Rosenthal, Chief of the Division of Occupational Outlook.

Mr. GORE. Neal Rosenthal, Chief of the——

Mr. KUTSCHER. The Division of Occupational Outlook.

Mr. GORE. The Division of Occupational Outlook. That is separate from the Employment and Training Administration?

Mr. ROSENTHAL. Yes. That is located in the Bureau of Labor Statistics, not the Employment and Training Administration.

Mr. GORE. OK. Fine.

Without objection, your entire prepared statement will be included in the record, following your oral presentation. If you can summarize some portions of it, we would appreciate that, in view of the lateness of the hour.

STATEMENT OF RONALD KUTSCHER, ASSISTANT COMMISSIONER, BUREAU OF LABOR STATISTICS, U.S. DEPARTMENT OF LABOR, WASHINGTON, D.C., ACCOMPANIED BY NEAL ROSENTHAL, CHIEF, DIVISION OF OCCUPATIONAL OUTLOOK

Mr. KUTSCHER. I will try to do so.

The Bureau of Labor Statistics has a program for developing employment and occupational projections. I will try to summarize briefly that program, and describe some of the results.

The projection program of the BLS provides projections of the U.S. economy, including employment by industry and occupation. These projections cover a 10-year ahead period and are updated on a 2-year cycle. They are used in updating publications on a regular basis, such as the Occupational Outlook Handbook.

In providing these projections, we utilize a set of data and models that allows us to try to capture the major factors that influence trends in employment by industry and occupation.

In my statement, I summarize these as covering two broad categories: Changes in the demand for goods and services, whether that is by consumers, government, or business; and, also, changes in the manner in which we produce goods and services.

Our system is designed to try to capture changes in the patterns of consumption, government expenditures and investment, and how those impact on the changing distribution of employment by industry and occupation.

The second element that can influence future jobs is changes in technology, and our system is also designed in a way to try to capture such changes.

A number of references were made this morning to the fact that it would be useful to utilize an input-output model in developing projections. The Bureau has, in fact, utilized an input-output model in developing our industry and occupational projections since the mid-sixties. Through that, we have a means of capturing changes in technology.

However, as I very carefully point out in my written testimony, we would have to be less than honest if we did not point out the difficulty in trying to capture all of the changes that can take place in technology and how resulting technological changes are captured in our model.

The second factor that I think is important in understanding the data developed by the Bureau of Labor Statistics, is that the information that we use on occupational information comes from an employer-based survey called the occupational employment statistics program. That program is a sample survey of about a half a million employers, in which we regularly collect information on the occupational patterns of employment in each of the industries. Now, that is an ongoing survey at both the national and the State levels.

One of the elements in that collection program is that we ask each employer, as a regular part of the survey, to list occupations that we do not regularly put in our so-called stub. In other words, if we are using an old set of occupations, as some witnesses have said, we specifically ask the employer to update the occupational listing that we have by adding to that any new occupation that may not be on our information stub that we sent them.

Consequently, through this mechanism which, as I said, is a regular ongoing survey, not only at the national level but in each of the 50 States, an important data input is provided us, which we use in developing the projections.

Thus, through the input-output model, where we try to capture changes in technology over time and the industry occupational model, which is derived from the data base that I just described, we have a very detailed picture of current employment by industry and occupation. The current industry occupational matrix at the national level, for example, gives us a breakdown of employment by industry into well over 1,000 occupations. Obviously, no one industry has a thousand occupations, but across the country and in all types of industries we do have that type of information. Therefore, that detailed data on occupations is incorporated into the data base that we use in developing the projections. Consequently, by linking the economic model with the input-output model and the industry occupation model, we are able to develop alternative economic projections, and analyze the implication of these alternative projections for employment by industry and occupation.

That information is then the data base, the information base, that we put in our regular publications, like the Occupational Outlook Quarterly and the Occupational Outlook Handbook. In other words, these documents on job forecasts that we provide are based on the best information we have on current job pictures and, to the extent we can capture in our economic models, changes that the future will have.

As I describe in my written testimony—of course, that is only one dimension of the job market. That only looks at the changes in demand for workers by occupation. If you are also concerned about labor supply, then a number of other elements come into being on labor supply; that is, the number of people in training, the occupational mobility, and other elements, in order to analyze whether a given occupation is likely to be in surplus or shortage situations sometime in the future.

Of course, for a long distance period, such as 10 years ahead, it is not really possible to capture whether or not an occupation that has relatively low skills is likely to be in a shortage situation because the training period for that occupation is so short.

However, even for an occupation that has a relatively long training period—and in my testimony I use engineers as an example—the information and data base that we have begun to develop on occupational mobility illustrate the enormous amount of flexibility in the job market. Therefore, even though we think of an engineer as being an occupation that requires a great deal of specific training, in fact, when we look at how engineering jobs are filled, they come not only from new trainees, but from individuals that are transferring in from other occupations.

As I spell out in my testimony, on an average, for every job opening in the economy, one comes from growth and nine come from occupational mobility. Now for low-skilled occupations, that ratio may be 20 to 1 or even higher. Even for relatively high-skilled occupations, such as engineering, nearly two-thirds of the job openings come from individuals that leave the job. Only about one-third of job openings for engineers come from growth.

Therefore, the important dimension that has to be kept in mind is that growth, job growth, is only one of the elements important in the future job market.

Mr. GORE. How many of them come from job shifting?

Mr. KUTSCHER. On the average, it is nine to one. In other words, shifting into another occupation or, in some cases, it may be shifts out of the labor market, but on the average it is 9 out of 10. Now that varies considerably between various skills. For an engineer, it is two out of three.

Mr. GORE. All right. Thank you.

Mr. KUTSCHER. In my formal remarks, I summarize the major employment trends between the goods-producing and service-producing industries. I also summarize the trends by major occupational groups. Those remarks are there for study.

I think I would like to emphasize, however, that there are a number of different ways of looking at the job market. An awful lot has been made about rapid rates of growth, and that is one very important way of categorizing the job market.

In my formal testimony I list three tables, one of which is the "Fastest Growing Occupation for Which a High School Diploma or Less Is Adequate Preparation." If you examine those occupations, they have relatively rapid rates of growth. Perhaps that is more importantly emphasized when we go to the next two tables, which show the fastest growing occupations that generally require some postsecondary training and the final table, which is the fastest growing occupations requiring a bachelor's degree.

The emphasis on the last two tables, some of which draws largely from computer systems analysts, computer programers, computer mechanics—in other words, what has become known as high tech-type occupations. They do have in our system, or are shown to have, very rapid rates of growth.

However, we would also like to emphasize that there is another dimension of the job market. One of the parts of our system is that we account for and project all jobs of the future.

When you look at all jobs, a somewhat different picture emerges. We list in table 4 of my formal remarks, 37 occupations that we project will account for over one-half of total employment growth between now and 1990.

In fact, if you look at the top 10 of those, which account for nearly a quarter of the jobs, you find that those jobs are made up of secretaries, nurses' aides, janitors, sales clerks, cashiers, nurses, truck drivers, food service workers, general clerks, waiters, and waitresses. Therefore, there are two different dimensions that one has to keep in mind.

I am not emphasizing this to say that the rapid growth of the others is not important, but just saying that there are two sides to the job market. An awful lot of jobs now and in the future will continue to be in those occupations that are traditional.

Another way of emphasizing that is to look at the last decade when, by anyone's measure, the computer occupations have had a very, very dramatic growth. Five occupations—programers, systems analysts, computer specialists, computer operators, keypunch and other data entry operators—have had growth rates of 136 percent, 227 percent, 477 percent, 200 percent, and 28 percent respectively. Yet, over the last decade in total, these 5 occupations have only accounted for 5 percent of the total job growth.

Therefore, you can have rapid rates of expansion of jobs from a very low employment base, and yet still account for only a very small proportion of the total projected growth in the job.

In my formal submission, I also submitted another part of our regular program at the Bureau, and that is an evaluation of our past projections, which we regularly do and publish the results, so that the public can see how accurate we have been in our past forecasts, and they can judge how much value and how much weight they should put on that. Those will be made a part of my formal submission.

Mr. Chairman, thank you very much for inviting me to testify. This concludes my formal testimony. I await your questions.

[The prepared statement of Ronald Kutscher follows:]

Testimony of
Ronald E. Kutscher
Associate Commissioner
Bureau of Labor Statistics
before
House Committee on Science and Technology
Subcommittee on Investigation and Oversight
April 6, 1983

Chairman Core and Members of the Subcommittee on Investigations and Oversight, it is a pleasure to be asked this morning to describe for you the program of the Bureau of Labor Statistics in the employment and occupational projections field. In my testimony I will cover five major topics. (1) I will briefly review the program of the Bureau of Labor Statistics which provides industry and occupational employment projections, (2) the major factors that affect trends in occupational employment, (3) how projections are developed in the Bureau of Labor Statistics, (4) the major long-term trends in employment at the industry level and at the occupational level that emerge from the analyses done as a part of the Bureau of Labor Statistics projections program, and (5) highlights of some reports, articles, and analyses that I will be submitting for the record.

The projections program of the Bureau of Labor Statistics provides projections of the U.S. economy including employment by industry and occupation. These projections typically cover a 10 year ahead horizon and are updated on a regular two year cycle. The projections are developed under alternative economic assumptions and the results are presented in varying formats to meet the needs of diverse users. The Occupational Outlook Handbook, designed principally for high school and college students and counselors to these students, is one of the ways the projection results are presented. Other publications are designed to meet the needs of educators and training specialists, the research community, and others interested in employment and occupational trends. Another important element of the projections program in the Bureau is a regular detailed evaluation of each set of projections once we have reached the projection period covered by the projections.

Factors Affecting Trends in Employment by Occupation

The second item that I will discuss is the factors that affect trends in employment by occupation. These factors can be broadly grouped into two categories, (1) changes in demand for goods and services, and (2) changes in the way in which goods and services are produced. With regard to the first of these factors, changes in demand for goods and services, many elements enter into why consumers, government, and businesses change the types of goods or services they purchase. For consumers it can be simply a matter of changing tastes. If consumer tastes change, for example, from soft drinks to beer, this would shift demand away from the soft drink industry toward the industry that produces beer. If forms of entertainment were to change from skiing to home computers, then producers of equipment used in ski resorts and operators of these resorts would suffer with that decline and producers of home computers, dealers and software producers would benefit from this change in consumer taste or recreational patterns. Each of the industries that would be affected, producers of soft drinks and beer, and operators of ski resorts and home computer manufacturers and distributors, require somewhat different occupational skill mixes of their employees. Therefore, changes over time in consumer preferences would affect the occupational makeup of the country.

The changing distribution of government purchases, whether at the federal level or the State and local level, also can have similar implications. If the Federal Government changes its priorities and expands defense expenditures, employment in industries producing defense goods such as aircraft, missiles, and electronics would very likely increase. These industries have a specific mix of occupational skills that is different from those industries that produce services that some other part of the Federal Government may buy. Of course, the same holds true at the State and local government level. If State and local governments shift from providing social services to building or repairing highways, a different occupational skill mix would be required to perform these services.

Just as with consumers or government, emphasis by business on one type of investment good over another can cause similar shifts in demand. Business may be purchasing computers in one period and shift to trucks, soft drink bottling machinery, or duplicating equipment in a later period. Again, such changes in business investment patterns also have implications for the economy's future distribution of employment by industry and by occupation.

Also, added to this change in consumer preferences and government or business priorities, is the question of whether the goods and services in demand are provided by domestic or foreign producers. Consumers may demand more electronic goods as, for example, video tape recorders or home computers. However, the skill distribution of the economy is greatly affected depending on whether this demand is provided by domestic or foreign producers.

The second broad factor that affects occupational and industry employment changes over the long run is the manner in which goods and services are produced. Even if consumers, governments, or businesses were not changing their demand for goods or services, changes in the occupational composition of the work force come about because of changes in the ways in which the same goods or services are produced. As an example, if the production of a manufactured good is automated, this may require more, less, or the same level of employment, but it likely will require a different skill mix, which, of course, depends on the type of technology being introduced. Thus, the impact of change in production methods on the changing skill requirements in the economy is added to those caused by changes in consumer, government, and business preferences for goods or services. Both tend to interact on the economy by causing changes in the industrial mix of employment or changes in occupational mix within an industry.

How the Bureau Prepares Occupational Projections

The Bureau's system for developing occupational projections was designed to take into account, as best as we can, the factors described above that can influence trends in employment by industry and occupation. Of course, one has to be clear that developing projections of industry and occupational employment is an inaccurate operation because of the wide variety of factors that come into play.

The preparation of economic projections uses, to a degree, both science and judgment. Thus, misunderstandings may arise between the users, who feel the need for exact numbers, and producers, who recognize their inability to predict with such precision. Such conflicts are all the more likely because projections analysts generally employ a framework which develops numerical answers to specific questions, and users are inevitably tempted to attribute to those numbers an exactness they should not be accorded. The Bureau of Labor Statistics attempts to address this dilemma, in at least a small way, by making clear all the important assumptions underlying our projections, by developing alternative versions which reflect at least some of the uncertainties about the future, by evaluating past projections to assist users in appreciating the unpredictable nature of certain events, and by updating the projections on a regular 2-year cycle. Even so, the Bureau is aware that many uses of the projections require quantitative estimates. It is incumbent on users to realize that differing assumptions can change the results; that underlying data and methods can cause errors; that structural changes, such as sudden changes in relative prices of energy, occur which cannot be dealt with effectively; and that estimates should be carefully reviewed to take into account subsequent developments which could not be anticipated at the time the projections were prepared.

The projection system used by the Bureau of Labor Statistics can be viewed as several discrete steps or elements which are closely related to each other. First, we develop labor force projections by age, sex, and race. This provides an estimate of the total number of people available for work and their demographic composition. Second, we use an economic model and a specified set of assumptions to develop projections of economic growth and its composition. Composition of GNP encompasses changes in consumer demand for goods or services, changes in trends of Federal and State and local government expenditures, business and residential investment, and changing patterns of exports and imports. Third, these overall aggregate economic projections and the changes in distribution of demand are translated into industry output and employment requirements by using an input-output model. Lastly, employment by industry is translated into occupational employment using an industry occupational matrix, which shows the staffing patterns for each industry in the economy. These steps, when combined, provide projections of occupational employment for a future time period under a specified set of economic assumptions.

The changes in consumer, business and government demand are included in the portion of the projections that translate overall economic growth into detailed demand by category. Technological change enters the projections in two explicit ways. The input-output portion of the Bureau's projection system depicts the relationships among industries by showing what they buy and sell each other to produce goods and services. These input-output relationships can change for a number of reasons including changes in technology. For example, firms within an industry can begin purchasing outside accounting services formerly performed inside the firm or clerical work performed by hand can be done by computer necessitating the purchasing of a computer, computer parts, software and other inputs needed to operate a computer. Second, the staffing patterns by industry can also change due to many factors including technological change. In the examples noted above, if firms within an industry decided to purchase outside accounting help, not only would a purchase of accounting services show up in the input-output model but a decline of accountants in that industry would also show up in the industry-occupational matrix. Similarly, changes from hand calculation to computer calculation would induce changes in the occupational mix. In developing projections, we attempt to take into account the impact that technology will have at both of these points in our projections process. In this work, studies conducted in the Bureau's Office of Productivity and Technology of technological changes occurring in industries are important. However, even with these studies and other analyses developed, the future impact of technological change is very difficult to forecast both as to its speed, to its dispersion, and to the exact quantification of its impact. Consequently, we would be less than honest if we did not say that a large element of judgment enters into this aspect of our projections. To the extent that we fail to capture future technological change the projections can be in error, just as they can be if our assumptions are unrealistic or if we do not correctly gauge a change in consumer preferences or government priorities. Both of these point up the uncertainties attached to developing detailed projections of employment at an industry and occupational level.

While this system develops projections of occupational demand, other related elements such as education and training requirements, and future job prospects in specific occupations depend on additional considerations. Thus, projections of employment by themselves do not indicate what the likely supply-demand situation is going to be in a given occupation. In developing data on supply-demand balances and future job openings, it is very important to emphasize that, on average, nine out of ten job openings in the economy stem from the need to replace workers who leave their occupation rather than from growth. It is also important to emphasize that this overall average varies considerably. For example, in some lower skill occupations, the relationship between openings due to replacements and growth may be 20 - 1, while for other occupations at the high end of the skill spectrum, a much smaller relationship exists. Also, it is important to note that while the Bureau has studied and developed over many years data and a system for projecting growth in employment, job openings due to occupational mobility is something on which we have only recently begun to develop data and on which, as a consequence, we have far less knowledge.

It is also necessary to point out that it is not really possible to assess supply-demand balances for some period far into the future for those occupations which have a very short training or education requirement. For example, if the training requirement for a cashier, or a truck driver is a few weeks or months at most, it is not meaningful to say there will be a shortage of truck drivers or cashiers in 1990. Market forces, through the adjustments of wages could eliminate a shortage if it developed--unless, of course, working conditions or other factors were causing the shortage. For some jobs, maids or household servants comes to mind, the status attached to the work is such that wages alone would probably not bring about a supply-demand balance. Therefore, the occupational categories where projections of future occupational shortages have most value are in those skill classifications where there is a considerable lead time in education or training. However, even for these occupations it is very difficult to assess future supply-demand conditions because supply can come not only from newly trained individuals, but also from individuals trained in this occupation in the past but who are temporarily working in other occupations (or not working at all), or from individuals who have education and training in a skill closely related enough that employers feel that with some very short break-in period the worker could perform the work. Because of all the uncertainties attached to sources of supply, the Bureau is very reluctant to label job categories or occupations as being in a shortage situation. Even in categories where the lead time may be a number of years such as engineers, it is difficult to assess whether or not there may be a sufficient number of individuals who possess closely related enough skills to perform the work.

The Bureau has recently developed a data series that has enabled us to do some in-depth analysis of occupational mobility. One of the important insights gained from these data is that there is significant mobility in the nation's work force even among occupations such as engineers that have considerable training or education requirements. Since mobility depends on a variety of economic factors, it is very difficult to use these data to evaluate future supply. Further complicating assessments of future supply in a given occupation is that the number of individuals in a career-oriented education program do not always enter the occupation in which they are trained. For example, it is estimated that only 80 percent of the graduates of engineering schools eventually become engineers. That may be due to job market factors or it could be due to personal preferences. All of this only serves to point out the uncertain nature of developing highly accurate projections of job openings by detailed occupation and assessment of the supply-demand balances for an occupation five to ten years ahead. For this reason, we present our projections in terms that are carefully worded so as not to give an impression of a precision that is clearly not there.

Major Long-Term Trends

I would like to turn now to a review of the major trends emerging from the Bureau's projection analyses. Before doing so, I would note that, since these projections are developed on a two year cycle, they do not always incorporate the Administration's latest economic forecast. I will begin that review with the labor force. The civilian labor force, consisting of people with jobs--wage and salary workers, self-employed workers, and unpaid family workers--and people looking for jobs--the unemployed, through the late 1960's and the 1970's grew tremendously. This growth resulted because many people born during the "baby boom" entered the job market, and an increasing proportion of women in the population sought jobs. In 1980, the civilian labor force totaled about 105 million persons--63 percent of the noninstitutional population 16 years of age and over.

The labor force is projected to continue to grow during the 1980's but at a slower rate than in recent years. By 1990, the size of the labor force is expected to range from 122 to 128 million persons, a 17 to 22 percent increase over the 1980 level. Contributing to this growth will be the expansion of the working age population and the continued rise in the proportion of women who work. The labor force will grow more slowly between 1985 and 1990 than in the early 1980's. This slowdown will result from a drop in the number of young people attaining working age and on a projected less rapid growth of the participation rate of women.

To discuss employment trends and projections by industries, it is useful to divide the economy into nine industrial sectors under two broad groupings--service-producing industries and goods-producing industries. Over two-thirds of the Nation's workers are currently employed in industries that provide services such as health care, trade, education, communication services, government, transportation, banking, and insurance. Industries that produce goods through farming, construction, mining, and manufacturing employ less than one-third of the country's work force.

Over the last two decades a number of important shifts in employment have taken place in the economy. Perhaps the most publicized among these is the relative shift away from the goods-producing sectors to the service-producing industries. Most of the employment growth over the last two decades has been growth in service-producing industries with little absolute job increase among the goods-producing industries. Within the goods-producing sector agriculture has had employment declines, while the manufacturing sector has declined in relative terms but not in absolute levels.

SERVICE-PRODUCING INDUSTRIES. Employment in service-producing industries has been increasing at a faster rate than employment in goods-producing industries in the past and that pattern is projected to continue. Employment in the service-producing industries is projected to increase from 65.7 million workers in 1980 to between 78.7 and 83.5 million in 1990 or by 20 to 27 percent. However, growth will vary among industries within the group. The following paragraphs summarize recent trends and the projections of employment in the five industrial sectors that make up the service-producing industries.

Transportation and Public Utilities. This is the slowest growing sector of the service-producing industries. Between 1970 and 1980, employment in this sector increased only one-third as fast as in the service-producing industries as a whole due largely to declining employment requirements in the railroad and water transportation industries. However, even in the communications industries where demand has increased greatly, technological innovations have allowed for the expansion in services with a relatively small employment growth. Between 1980 and 1990, employment in the transportation, communications, and public utility sector is expected to rise from 5.5 million to between 6.5 and 7.1 million workers, or by 12 to 22 percent.

Trade. Both wholesale and retail trade employment have increased as the population has grown and as rising incomes have enabled people to buy a greater number and variety of goods. Retail trade grew slightly faster than wholesale trade during the 1970's, 38 percent compared to 32 percent--as expansion of the suburbs has created a demand for more shopping centers. Between 1980 and 1990, wholesale and retail trade employment is expected to grow from 20.6 million to between 25.1 and 26.9 million workers, or by 22 to 31 percent. Employment will continue to increase faster in retail trade than in wholesale trade, 24 to 31 percent compared with 17 to 28 percent.

Finance, Insurance, and Real Estate. This sector grew 42 percent between 1970 and 1980 as these industries expanded to meet the financial and banking demands of a growing population. Between 1980 and 1990, employment in this sector is expected to rise from 5.2 million to between 6.5 and 6.9 million workers, or by 26 to 34 percent. A growing population that increasingly uses credit to finance purchases will keep the consumer demand for credit and other financial services high. In addition, businesses will need assistance to finance the expansion of their plants and the purchase of new equipment.

Services. This sector includes a variety of industries, such as hotels, barber shops, automobile repair shops, business services, public and private hospitals, nonprofit organizations, and public and private education. Employment in this sector increased 37 percent between 1970 and 1980. High demand for health care, business services, advertising, and commercial cleaning services has been among the forces behind this growth. From 1980 to 1990, employment in the service industries is expected to increase from 26.2 million to between 31.6 and 33.5 million workers, or by 20 to 28 percent, and will provide more new jobs over this period--5.4 to 7.3 million--than any other industry sector. Employment requirements in health care are expected to grow rapidly due to continued increases in demand because of population growth--particularly the elderly--and rising incomes and increased health insurance coverage that increase people's ability to pay for medical care. Business services, including accounting, data processing, and maintenance, also are expected to grow rapidly.

Government. Increased demand for services provided by the government-- social services and welfare, and police and fire protection--caused employment in the government sector (excluding education and hospital services) to rise about 36 percent between 1970 and 1980. Employment in State and local governments expanded 47 percent compared to 13 percent for the Federal Government. As a result of public desire to limit government growth, employment is expected to rise only 14 to 16 percent.

GOODS-PRODUCING INDUSTRIES. Employment in the goods-producing industries rose only 10 percent between 1970 and 1980. Significant increases in outputs accompanied by gains in productivity resulting from automated production, improved machinery, and other technological changes permitted large increases in output without significant change in employment. Between 1980 and 1990, employment in goods-producing industries is expected to increase from 29 million to between 32.5 and 35.5 million workers, or by 13 to 22 percent. Growth rates will vary among the four sectors that make up this group --agriculture, mining, construction, and manufacturing.

Agriculture. Employment in agriculture, which has long been declining, dropped an additional 7 percent between 1970 and 1980, while farm output increased through the use of more and better machinery, fertilizers, feeds, and pesticides. Between 1980 and 1990, employment is projected to continue declining but in absolute amounts less than in earlier periods.

Mining. Having declined through most of the 1960's, employment in the mining sector increased substantially during the 1970's. Employment rose about 65 percent between 1970 and 1980, mostly because of the country's renewed emphasis on developing energy sources. Continued growth of between 20 and 30 percent is projected for the 1980's.

Construction. Despite several economic slumps, employment rose 25 percent between 1970 and 1980, because of strong demand for houses, apartments, office buildings and highways. Between 1980 and 1990 employment in the construction sector is expected to increase from 4.5 million to between 5.6 and 6 million workers or 24 to 34 percent.

Manufacturing. Although a growing population and rising incomes have increased demand for almost all types of goods, improved production methods and stiff foreign competition limited employment growth in many manufacturing industries during the 1970's. In fact, employment grew more slowly in manufacturing than in any other sector except agriculture between 1970 and 1980, only 5 percent. Manufacturing employment is expected to rise to between 23.3 and 25.3 million workers by 1990, a 15 to 24 percent increase from the 1980 level of 20.4 million workers. This somewhat more rapid expansion for manufacturing in the 1980's is related to the expected defense build-up and somewhat greater emphasis on investment goods expected in this decade.

Manufacturing is divided into two broad categories, durable goods and nondurable goods. Employment in durable goods manufacturing is expected to increase by about 19 to 30 percent, while employment in nondurable goods manufacturing is expected to increase by only 8 to 25 percent. Growth rates will vary among individual industries within each of these categories. In nondurable goods industries, for example, employment in bakeries is expected to decline, while a moderate rise in employment is projected for the paper industry. Among durable goods industries, computer equipment manufacturing is expected to show a rapid employment increase.

Occupational Profile

Customarily, occupations are divided into white-collar occupations--professional and technical, clerical, sales, and managerial jobs; blue-collar occupations--craft, operative, and laborer jobs; service occupations; and farm occupations. Growth rates among these groups have differed markedly. Once a small proportion of the total labor force, white-collar workers now represent about half of the total. The number of service workers also has risen rapidly, while the blue-collar work force has grown only slowly and farm workers have declined. The following section describes projected changes among the broad occupational groups between 1980 and 1990.

Professional and Technical Workers. This category includes many highly trained workers, such as scientists and engineers, medical doctors and health technicians, teachers, computer specialists, pilots, and accountants. Between 1980 and 1990, employment in this group is expected to grow from 16.4 million to between 19.9 and 20.7 million workers or about 20 to 26 percent.

Managers and Administrators. This group includes workers such as bank officers and managers, buyers, credit managers, and self-employed business operators. Between 1980 and 1990, this group is expected to grow from 9.4 million to between 10.6 and 11.3 million, or up 13 to 21 percent.

Changes in business size and organization have resulted in differing trends for self-employed and salaried managers. The number of self-employed business managers will continue to decline as large corporations and chain operations increasingly dominate many areas of business. Some small businesses, such as quick-service groceries and fast-food restaurants, still will provide some opportunities for self-employment. The demand for salaried managers will continue to grow as firms increasingly depend on trained management specialists, particularly in highly technical areas of operation.

Clerical workers. This constitutes the largest occupational group and includes bank tellers, bookkeepers, secretaries, and typists. Between 1980 and 1990, employment in these occupations is expected to grow from 18.9 million to between 22.4 and 23.9 million workers, or by 19 to 27 percent. Although new developments in computers, office machines, and dictating equipment will enable clerical workers to do more in less time and will change the skills needed in some jobs, continued growth is expected for most clerical occupations. Exceptions include keypunch operators and stenographers which will be affected significantly by new technology. Conversely, however, the more extensive use of computers will greatly increase the employment of computer and peripheral equipment operators.

Sales Workers. These workers are employed primarily by retail stores, manufacturing and wholesale firms, insurance companies and real estate agencies. Employment of this group is expected to grow from 6.8 million to between 8.1 and 8.8 million workers, or by 19 to 28 percent.

Craft Workers. This group includes a wide variety of highly skilled workers, such as carpenters, tool-and-die makers, instrument makers, machinists, electricians, and automobile mechanics. Between 1980 and 1990, employment of this group is expected to increase from 12.4 million to between 14.6 and 15.8 million, or by about 18 to 27 percent.

Employment in many craft occupations is tied to trends in a particular industry. Employment in nearly all construction crafts, for example, are expected to grow because of rising demand for construction. In contrast, the long-run employment decline in the railroad industry will lessen the demand for some craft occupations concentrated in that industry, such as railroad and car shop repairers. Because of advances in printing technology, very little growth is anticipated in the printing crafts.

Operatives. This group includes such production workers as assemblers, production painters, and welders. Between 1980 and 1990, employment of operatives is expected to rise from 10.7 million to between 12.2 and 13.2 million workers, or by 14 to 23 percent.

Employment of operatives is tied closely to the production of goods, because the majority of these workers are employed in manufacturing industries. The projected slow growth of some manufacturing industries along with improved production processes, will hold down the demand for many of these workers. Employment of some textile operatives, for example, is expected to decline as more machinery is used in the textile industry.

Transport Operatives. This group includes workers who drive buses, trucks, forklifts, and taxis. Employment in most of these occupations will increase because of the greater use of most types of transportation equipment. Some occupations, such as busdriver and sailor are expected to grow only slowly. Between 1980 and 1990, the number of transport operatives is expected to rise from 3.5 million to between 4.2 and 4.4 million workers or by 18 to 26 percent.

Nonfarm Laborers. This group includes workers such as garbage collectors, construction laborers, and freight and stock handlers. Employment in this group is expected to grow only slowly as machinery increasingly replaces manual labor. Power-driven equipment, such as forklift trucks, cranes and hoists will handle more material in factories, loading docks, and warehouses. Other machines will do excavating, ditch digging, and similar work. Between 1980 and 1990, employment of laborers is expected to increase from 5.9 million to between 6.7 and 7.1 million workers or by 14 to 22 percent.

Service Workers. This group includes a wide range of workers--firefighters, janitors, cosmetologists, and bartenders are a few examples. These workers, most of whom are employed in service-producing industries, make up the fastest growing occupational group. Factors expected to increase the need for these workers are the rising demand for health services, commercial cleaning services and--as incomes rise--more frequent use of restaurants, beauty salons, and leisure services. Between 1980 and 1990, employment of service workers is expected to increase by about 24 to 32 percent from 14.6 million to between 18.1 and 19.2 million workers.

In looking to the future there are a number of different ways one can categorize job growth. The first of these is to list those jobs with the most rapid rates of growth. Such lists are contained in the following three tables.

Table 1

Fastest Growing Occupations For Which A High School Diploma or Less is Adequate Preparation

Occupation	Projected Percent change in employment, 1980-90	Employment, 1980 (in thousands)
Food preparation and service workers, fast food restaurants	50-57	806
Correction officials and jailers	47-49	103
Nurses' aides and orderlies	43-53	1,175
Psychiatric aides	40-46	82
Dental assistants	39-42	139
Painters, automotive	38-44	41
Claims clerks	36-42	68
Dry wall applicators	35-46	52
Child care attendants	35-45	41
Insurance clerks, medical	35-41	29
Tapers (dry wall)	34-44	32
Welfare service aides	34-39	95
Statement clerks	34-38	33
Housekeepers, hotel and motel	33-46	50
Washers, machine and starchers (laundering, drycleaning)	33-46	59

Source: Occupational Projections and Training Data, BLS Bulletin 2202, December 1982

Table 2

Fastest Growing Occupations That Generally Require
Postsecondary Education and Training
(But Less Than a Bachelor's Degree)

Occupation	Projected Percent change in employment, 1980-90	Employment, 1980 (in thousands)
Paralegal personnel	109-139	32
Data processing machine mechanics	93-112	83
Computer operators	72-83	185
Office machine and cash register servicers	60-73	55
Tax preparers	49-70	31
Employment interviewers	47-64	58
Peripheral EDP equipment operators	44-52	49
Travel agents and accommodations appraisers	43-52	52
Claims agents	43-46	40
Brickmasons	40-51	146
Nurses, professional	40-47	1,104
Surgical technicians	39-45	32
Dental hygienists	39-42	61
Health records technologists	38-44	32
Concrete and terrazzo finishers	37-47	113

Source: Occupational Projections and Training Data, BLS Bulletin 2202, December 1982

Table 3

Fastest Growing Occupations
Requiring a Bachelor's Degree

Occupation	Projected Percent change in employment, 1980-90	Employment, 1980 (in thousands)
Computer systems analysts	68-80	205
Physical therapists	51-59	34
Computer programmers	49-60	228
Speech and hearing clinicians	47-50	35
Aero-Astronautic engineers	43-52	68
Economists	42-50	29
Dietitians	38-46	44
Electrical engineers	35-47	327
Medical laboratory technologists	34-42	105
Architects	33-41	80
Veterinarians	31-41	36
Law clerks	30-47	33
Geologists	30-38	40
Mechanical engineers	29-41	213
Psychologists	29-35	82

Source: Occupational Projections and Training Data, BLS Bulletin 2202, December 1982

An important dimension of these occupations, however, is that a number of these rapidly growing occupations are relatively small so that very rapid rates of growth still may involve, in absolute numbers, a relatively small number of jobs.

The following list contains those occupations with the largest numerical growth projected over the next decade. As can be seen from this list, the occupations rarely contain any of those that were listed among the most rapidly growing, reinforcing the point that rapid growth often takes place on a relatively small employment base. Thus, in considering future needs of the economy for workers of various skills, both dimensions need to be kept in focus--the most rapidly growing and those which may numerically provide the most jobs.

Table 4

The Following Occupations Will Account For 50 Percent Of All New Jobs Generated During The 1980's

Occupation	Projected Growth in Employment 1/ 1980-90 (in thousands)
Secretaries	700
Nurses'aides and orderlies	508
Janitors and sextons	501
Sales clerks	479
Cashiers	452
Nurses, professional	437
Truck drivers	415
Food service workers, fast food restaurants	400
General clerks, office	377
Waiters and waitresses	360
Elementary school teachers	251
Kitchen helpers	231
Accountants and auditors	221
Helpers, trades	212
Automotive mechanics	206
Blue-collar worker supervisors	206
Typists	187
Licensed practical nurses	185
Carpenters	173
Bookkeepers, hand	167
Guards and doorkeepers	153
Stock clerks, stockroom and warehouse	142
Computer systems analysts	139
Store managers	139
Physicians, medical and osteopathic	135
Maintenance repairers, general utility	134
Computer operators	132
Child care workers, except private household	125
Welders and flamecutters	123
Stock clerks, sales floor	120
Electrical engineers	115
Computer programmers	112
Electricians	109
Bank tellers	108
Electrical and electronic technicians	107
Lawyers	107
Sales agents and representatives, real estate	102

1/ Low alternative only

Source: Occupational Projections and Training Data, BLS Bulletin 2202, December 1982

Highlights. The projections that I have just described provide insights into a variety of topics. I would like to highlight one point which may be of importance to this Subcommittee. Most job openings will occur in existing occupations with the large majority in a relatively few fields. Although the Bureau has estimated employment in well over 1,000 occupations, about one-half of all job growth is projected to occur in only 37 occupations, as indicated in the table above. And, as can be seen from this list, many of these jobs will be in occupations that do not require extensive training. In addition, the point made earlier about only 1 of 10 job openings in the economy coming from growth with the other nine coming from occupational mobility, reinforces the point of needing to keep all dimensions of the job market in mind.

This same point is further emphasized by looking at the computer related occupations which over the last decade were among the more dynamic in the economy. Five occupations closely associated with the computer (programmers, system analysts, other computer specialists, computer operators, and keypunch and other data entry workers) experienced employment growth rates 1972-82, of 138; 227; 477; 200; and 28 percent respectively. Yet, overall, these five occupations only accounted for slightly over 5 percent of job growth over the period.

Finally, I have inserted for the record the results of some evaluations of our projections. In addition I am providing a brief description of the methods used to develop our projections. Mr. Chairman, thank you very much for inviting me to testify. This concludes my portion of today's testimony. At this time I will be happy to answer any questions that you or other committee members may have.

Chapter 18. Labor Force Projections

BLS develops and publishes long-term projections of the labor force—estimates of its future size and composition—as part of a comprehensive and integrated framework for analyzing the implications of growth for the national economy and for employment by industry and occupation. Projections, based on specified assumptions, are made for about 15 years ahead. Seven sets of labor force projections have been prepared since 1959. The most recent projections, for the labor force as a whole and for 54 separate age-sex-race groups, were published in December 1980 for 1985, 1990, and 1995.[1]

The basic assumptions that underlie all the labor force projections are: 1) Work patterns will not change significantly over the projection period; for example, the average workweek will not be sharply reduced; (2) social and educational trends will continue, such as the trend toward increased schooling beyond high school; and (3) there will be no major war or significant change in the size of the Armed Forces.

Methods

Projections of the labor force require, first, projections of the population. These are prepared by the Bureau of the Census by age, sex, and race, based on trends in birth rates, death rates, and net migration. Since birth rates pose the most uncertainty in projecting the population, the Bureau of the Census prepares several series of projections based on differing assumptions with respect to birth rates. The most recent BLS labor force projections incorporated the Bureau of the Census middle (Series II) birth rate projections, which have the total fertility stabilizing at 2.1 births per woman by the year 2050.[2]

Once population projections have been prepared, BLS projects labor force participation rates—the proportion of various groups in the population who will be working or seeking work. Projections are made for 54 separate demographic groups since both the level and trends of participation vary considerably by age, sex, and race. The labor force participation projection for each age, sex, and race group is developed by: (1) Analyzing past rates of growth, (2) selecting a time period deemed most appropriate for each group, and (3) modifying that rate if past trends are not likely to continue throughout the entire projection period.

The projected participation rate for each group is then multiplied by the corresponding population projection to obtain the labor force projection for that group. These are summed to obtain the total labor force. At each stage of projection, the results for specific age, sex, and race groups are reviewed and modified if not consistent with other demographic groups.

In recent years, three alternative sets of assumptions (scenarios) regarding labor force participation have been developed for each set of projections. In the latest projections, for example, one scenario, a *high-growth* scenario, assumes a rapid growth in the labor force participation of women in the 1980's and the convergence of participation rates of black and white men under the age of 65. (These rates have been diverging since 1955.) A second scenario, the *middle-growth* scenario, assumes only the rapid growth of women's participation. The *low-growth* scenario assumes a moderate rather than a rapid increase in women's participation and a continued divergence in the participation rates of black and white men.

New approaches

Since the last set of projections was prepared, the Bureau has been examining alternative ways to prepare labor force projections. The alternative under consideration is an economic model of labor force participation rates. The model just described is an extrapolation of past trends in participation rates to some target year with no explicit consideration of economic influences on participation rates.

Uses and Limitations

Labor force projections are a basic factor in estimating the amount of economic growth necessary to achieve specified levels of employment. They provide insight into the demographic characteristics of future workers and the implications of these for education and

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[1] Howard N. Fullerton, Jr., "The 1995 Labor Force: A First Look," Monthly Labor Review, December 1980.

[2] Bureau of the Census, Projections of the Population of the United States: [illegible] Current Population Reports, Series P-25, No. 704, 1977.

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U.S. Department of Labor
Bureau of Labor Statistics

Chapter 19. Economic Growth Studies

The primary objective of the Bureau's studies of economic growth is to develop projections of industry employment opportunities under alternative assumptions in order to analyze various economic problems such as the future utilization of available labor resources. A system of models serves as a basis for making the economic and employment projections.

Methods

Macroeconomic model

A macroeconomic model is used to project gross national product (GNP) and its major demand components under different sets of assumptions. These assumptions involve such factors as demographic trends, the unemployment rate, inflation, government tax and expenditure policies, and long-run productivity trends.

The macroeconomic model provides estimates of growth in the major sectors of the economy that are consistent with all assumptions and conditions of a particular projection scenario. The purpose of the aggregate projections is to provide consistent and integrated control totals for the projected industry purchases that are developed later in the system.

A macro model used recently was a relatively small-scale model (approximately 50 equations) whose purpose was to capture the impact of those factors which affect aggregate demand and supply over the medium to long term. The model was structured around a framework in which the output produced is balanced with output demanded via income flows. To bring about this balance between supply and demand GNP, the model was structured to respond to fiscal policy changes, which affect the level and distribution of spendable income in the personal and corporate sectors.

Assumptions made in developing the macro projections. There were 51 variables in this BLS macroeconomic model that were exogenous, or that had to be estimated externally in various ways for the projected periods. From a solution point of view, all exogenous variables are considered assumptions. From a structural approach, however, the exogenous variables were grouped in three ways. First were those items projected with sophisticated techniques outside the Office of Economic Growth and Employment Projections such as the population projections. Second were items which represented either policy instruments or policy goals. The policy instruments, such as Federal tax rates or Federal employment levels, represent the Federal Government's position at any particular time. The policy goals, such as the unemployment rate or the Federal deficit, were the result of such measures. Finally, there were those exogenous variables which were assumptions in the narrowest sense; i.e., a judgment as to the probable course of a particular item. An example of this category would be interest rates.

Balancing the macro model. Summation of the derived real components of demand yields the demand-side estimate of GNP. The demand- and supply-side estimates of GNP ordinarily will not agree, and the magnitude of such an imbalance is calculated. A positive sign for this gap represents a situation of excess supply, while a negative sign indicates excess demand. Although the sum of disposable incomes for all of the sectors necessarily equals the estimate of the GNP, demand for GNP will fall short of or exceed the supply of GNP unless the total purchases of the various sectors happen to equal their combined incomes.

The gap between supply and demand GNP depends in part on the government policies incorporated in the model. If there is a gap, this implies that the target rate of unemployment cannot be achieved with the existing fiscal assumptions. Thus, the various policy instruments in the model are modified to effect a balance between supply and demand. Many combinations are possible, and a final choice is made on the basis of many considerations that are outside the model.

Final demand projections

Gross national product is the final output of the economy measured from the demand side, or the output of the economy distributed among its final users. Final users are broadly categorized as persons, businesses,

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trends. Projected outputs by industry are first derived, then the projected investment output ratios are applied to derive the level of investment by each industry. This level of investment is run through a capital flows table giving a PDE bill of goods. This total investment is made to equal total PDE as derived from the macro model runs. Obviously, changes in the distribution of PDE by industry change the output level of each industry which causes a further change in the required investment. Adjustments are made repeatedly to the PDE column until PDE demand in each industry equals the level of investment that was actually required by the distribution of output.

Foreign trade projections. For most industries, the foreign trade projections rely on an analysis of the trends of imports and exports as shares of total output. The ratios for 1963, 1967, 1972, and, for merchandise trade, in 1977 are compared, and the trend carried out to future years. Ratios are applied initially to estimate imports and exports. The industry levels of imports and exports are added and scaled to the total values of the macro model.

The results are modified, in some cases, based on a comparison with previous BLS projections of imports and exports and special analyses. Where the previous projections relied on special analyses or special trade agreements that were still in effect, these are taken into account. Special studies are conducted for important import and export goods. For example, studies are made for automobile and electronic imports. Specific assumptions are made for the energy industries based, to the degree possible, on the Department of Energy's projected rates of growth for domestic output and imports under certain price conditions.

Government. The macroeconomic model estimates of projected State and local government purchases are consistent with all macro assumptions and estimates, including grants-in-aid. This model provides a purchase total for each projected year, with subtotals for education and for all other functions as a group. Both of these categories are divided into compensation and all other purchases.

A State and local government model has been recently used which predicts expenditures and employment in current dollars for 20 functions. These functions are projected based upon Census and BEA data by calendar year. They include: (1) Elementary and secondary education, (2) higher education, (3) other education, (4) libraries, (5) highways, (6) health, (7) hospitals, (8) sewerage, (9) public utilities, (10) natural resources, (11) corrections, (12) police, (13) fire, (14) sanitation, (15) public welfare, (16) local parks and recreation, (17) general government, (18) other government enterprises, (19) public housing, and (20) water and air terminals. The model structure is based upon data for the years 1960–73. Equations for each function are first estimated for expenditures and employment. Expenditures in the model are in current dollars and apply to all outlays, not just purchases of goods and services. Another set of equations is used to convert expenditures to purchases and compensation. A final set of equations is used to convert purchases to constant dollars. Employment is estimated in full-time equivalent units. The model is driven by four major groups of variables: Growth in personal income; demographic data; grants-in-aid; and an "all other" category that includes interest rates, prices, and unemployment rates.

The macro model levels of projected Federal purchases are established exogenously in the process of balancing supply and demand GNP. This model provides values for total purchases, total compensation of military and civilian employees, as well as the number of civilian and military employees. The levels are established to insure consistency with overall projection assumptions. Assumptions are of major importance in the Federal sector since, in many cases, past experience is not useful for projection. For example, the projections have always assumed peaceful conditions without international tensions. A contrary assumption of war would result in large Federal purchases and a much larger defense share.

Regression equations are used to derive the total purchases of the six Federal Government subfunctions used in deriving these projections. These are modified based upon expected program levels in the case of defense and space. The six subfunctions are modified until they come to the established macro totals for Federal Government expenditures. Real compensation is also derived for each subfunction using regression equations. Historical data for defense and nondefense new construction are used to derive regression equations to project purchases from the six new construction industries for each major component of the Federal sector; these two values are then allocated to the six subfunctions based on historical trends.

Projecting input-output coefficients

The input-output tables used as a base in the economic growth model are developed by the Bureau of Economic Analysis, Department of Commerce. However, these input-output tables incorporate the technology and product mix for a base year, and may not reflect the technology and product mix which may prevail during the period for which the projection is being made. Thus, it is necessary to project changes in the input-output coefficients.

Input-output coefficients are projected to change for several reasons—technological change is an important factor, but not the only one. Changes in product mix or relative prices could also cause significant changes in ment's report to international organizations on the long-term economic outlook for the United States. In addition, other Government agencies use parts of the economic growth projections to develop projections for their program needs. The projections of GNP and industry growth patterns are also used in private industry to make diversification studies, market analyses, and long-term capital plans.

The economic growth model permits analytical uses in addition to long-term employment projections. Specifically, the model can be used to generate the industry-by-industry labor requirements of various economic sectors or types of demand for recent years. Estimates of this type have been made for some time for national defense, consumption, exports, and other demand categories as a basis for the long-term projections and for special projects. The model also has been applied to estimate labor requirements for a variety of specific Federal Government programs, such as the sales of military equipment to foreign governments, defense expenditures, and energy programs.

The projections developed using the BLS Economic Growth system are prepared on a 2-year cycle and published in the *Monthly Labor Review*. The special studies of job requirements are also published in the *Review* but not on a regular basis.

The preparation of economic projections is, to a degree, both a science and an art. Thus, misunderstandings may arise between the users, who feel the need for exact numbers, and producers, who recognize their inability to predict with such precision. Such conflicts are all the more likely because projections analysts generally employ a framework which develops numerical answers to specific questions, and users are inevitably tempted to attribute to those numbers an exactness which they should not be accorded. The Bureau attempts to address this dilemma, in at least a small way, by making clear all of the important assumptions underlying its projections, by developing alternative versions which reflect some of the uncertainties about the future, by evaluating past projections to assist users in appreciating the unpredictable nature of certain future events, and by updating the projections on a regular 2-year cycle.

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Bureau of Labor Statistics

BLS Economic Growth Model System Used for Projections to 1990, Bulletin 2112, 1982.

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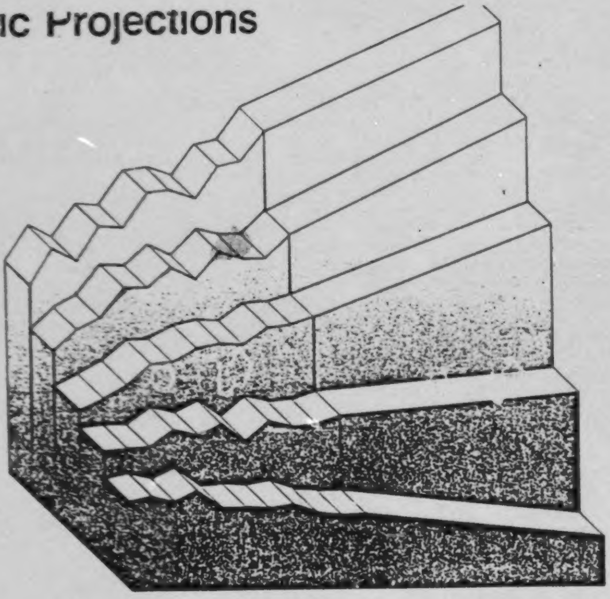
Economic Projections to 1990



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Chapter 20. National Industry-Occupational Matrix

The Bureau develops comprehensive data on employment in detailed occupations cross-classified by industry in the form of a matrix, or table. The matrix can be presented in absolute numbers or in ratios which show the proportion of total employment in each industry accounted for by each occupation. The data can also be transposed to show how total employment in an occupation is distributed by industry. The Bureau develops matrices for current and future years.

Sources of Data

Data used to develop industry-occupational matrices come from a variety of sources. Since 1980, the major source of occupational data has been the Occupational Employment Statistics (OES) survey.[1] (See chapter 3.) The OES survey collects data from employers on the occupational distribution of workers in all nonagricultural industries, except private households. Each industry is surveyed every 3 years.

The occupational distribution of wage and salary workers in agriculture and private households, not covered by the OES survey, is derived from the Current Population Survey (CPS) (chapter 1). Data on self-employed and unpaid family workers in each occupation also come from the CPS. The industry distribution of wage and salary employment is obtained through the BLS Current Employment Statistics (CES) program (chapter 2).

Methods

Current-year matrix

Separate estimates of current employment are developed for wage and salary workers in OES survey industries, for wage and salary workers in agriculture and private households, and for self-employed and unpaid family workers. Data on wage and salary worker employment are prepared by detailed occupation for each industry. Estimates of occupational employment of self-employed and unpaid family workers are prepared at the total (all-industry) level only. They are added to the total of wage and salary workers to derive total employment by detailed occupation for the entire economy.

Wage and salary workers in OES survey industries. OES data on occupational employment of wage and salary workers cover all industries except agriculture and private households. To develop current-year occupational employment estimates for OES industries, staffing patterns are calculated from the most recent survey for each industry. (Staffing patterns are the ratios of employment in each detailed occupation in an industry to total employment in the industry.) These staffing patterns are then applied to the current-year annual averages of industry employment taken from CES data.

In some industries, employment data for some detailed occupations are not collected in the OES surveys because the numbers are too small to be measured accurately and because the survey questionnaire in each industry is limited to 200 occupations. To develop total employment estimates for an occupation not included in a survey questionnaire, but which is known to be present, detailed occupational employment is disaggregated from the appropriate survey residual by using ratios derived from decennial census data. The disaggregation procedure is used to estimate employment in selected industries for about 100 occupations. The proportion of total 1978 employment estimated through the procedure was less than 4 percent.

The preliminary matrix developed through the procedures indicated above is reviewed in detail. The focus of the review is on the estimates generated through the disaggregation procedure. These are updated when the preliminary data are believed to be in error. Analytical judgment is used to make the updates.

Wage and salary workers in agriculture and private households. Total wage and salary worker employment in agriculture and in private households is developed from CPS data, although these are not strictly comparable with CES and OES data.[2]

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[1] The 1978 and 1980 matrices, developed in 1980 and 1981, were the first to be based on OES survey data. Prior to 1980, sufficient OES survey data were not available to develop national estimates, and national matrices were based primarily on the decennial census modified by more current data from the Current Population Survey (CPS). The primary source was changed from census CPS data to OES survey data because OES data, collected from employers according to specific occupational definitions, are believed to be more accurate than CPS data derived from a survey of households.

[2] In the CPS, each person is counted only once, in his or her primary job; in the CES and OES, a person is counted in all jobs he or she holds. Also, CPS and OES data may include workers younger than 16. Workers on unpaid absences are counted in the CPS but excluded from the CES.

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based on the distribution of current-year data. These distributions are reviewed and changes made where deemed appropriate. The resulting distribution is applied to projected totals for self-employed and unpaid family workers developed through the Bureau's economic model. The resulting projected employment totals are reviewed for consistency with information developed in the course of other occupational research, and changes are made where necessary.

Presentation

A current-year and projected-year matrix are developed on a 2-year cycle which coincides with the cycle used by the Bureau to develop economic, industry, and occupational projections. Summary data from the matrix are published in the *Occupational Outlook Handbook* and in other Bureau publications.

Because of the large size of the latest set of matrices—for 1980 and 1990—which include about 1,600 occupations and 378 industries, they have not been published as a Bureau bulletin. However, data for 689 detailed occupations and 378 detailed industries are available on computer tape which may be obtained at cost from the Bureau.[4] In general, only occupations with 5,000 or more workers are included on the tape. Hard copy of the data on the tape is available through the National Technical Information Service.

Uses and Limitations

The industry-occupational matrix provides a comprehensive set of data on the distribution of occuptional employment by industry and enables comparison of the occupational structure of industries. Other uses include studies of the changing utilization of workers by industry over time, analyses of occupational skill requirements in new and emerging industries, and market research.

The industry-occupational matrix also is used in studies which measure the occupational effects of changes in the level of expenditures by the Federal Government for specific programs. The national matrix is also used by State employment security agencies to develop estimates of current and projected employment for States and areas within States.

Because the matrix is based on information obtained from the OES survey and the CPS, it is subject to the response and sampling limitations typical of surveys. (See the sections on limitations of these surveys in chapters [illegible] and 3.) Further errors result from some of the necessary analytical adjustments in combining data from the two surveys and in estimating employment for detailed occupations not included in the OES survey questionnaire. The matrix data, therefore, indicate only the general level and position occupations hold in relation to other occupations within each industry. Consequently, the estimates should not be viewed as precise measurements. In general, the smaller the occupational estimates, the less the reliability.

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[4] Contact the Division of Occupational Outlook, Bureau of Labor Statistics, U.S. Department of Labor, Washington, D.C. 20212, for details on how to purchase this tape.

Technical References

Bureau of Labor Statistics

The BLS Economic Growth Model System Used for Projections to 1990, Bulletin 2112, 1982.

The National Industry-Occupational Matrix, 1970 1978, and Projected 1990, Bulletin 2086, 1981.

The National OES-Survey-Based Industry-Occupational Employment Matrix, 1978 and [illegible]90, scheduled for release in 1982 through U.S. Department of Commerce, National Technical Information Service.

Chapter 21. Occupational Outlook

The major objective of the occupational outlook program is to provide information on future employment opportunities by occupation for use by counselors, educators, and others helping young people choose a field of work and for local and national officials who plan education and training programs. Analyses of occupations include information on the nature of the work, employment, education and training requirements, the job outlook for about 10 years ahead, earnings, and related occupations.

Sources of Data

Many sources are used to develop occupational information. The basic statistics on current employment are derived from the Bureau's Occupational Employment Statistics surveys, which provide data by occupation for wage and salary workers in nonagricultural industries, except for private household workers. (See chapter 3.) Employment data for workers in agriculture and private households and for self-employed and unpaid family workers are derived from the Current Population Survey. (See chapter 1.) Employment data by industry are derived from the Bureau's Current Employment Statistics program (chapter 2). The occupational distribution of employment within industries—industry staffing patterns—is available through the Bureau's industry-occupational matrix (chapter 20).

Analyses of past and projected changes in employment make use of statistics on output, hours of work, and output per worker hour from BLS studies of productivity and technological developments. Information from the Office of Personnel Management is used to study trends in employment of Federal Government workers, and data compiled by Federal regulatory agencies, such as the Federal Aviation Administration and the Interstate Commerce Commission, are used to study employment trends in activities associated with those agencies. Data are also obtained from unions, industry and trade associations, and professional societies.

Analyses of past and probable future supply of workers use still other sources of information. The National Center for Education Statistics provides data on graduates from high school, junior or community colleges, vocational education programs, and 4-year colleges and universities. The Bureau of Apprenticeship and Training of the U.S. Department of Labor supplies information on apprenticeship completions, and the Employment and Training Administration of the department supplies data on enrollments and completions in training programs supported by funds provided under the Comprehensive Employment and Training Act (CETA). Also used are studies conducted by a variety of private organizations on the supply and occupational mobility of trained workers.

Earnings information is drawn primarily from BLS wage and earnings surveys. These are supplemented with information from Federal regulatory agencies, labor organizations, professional societies, and other groups.

Information also is obtained from: (1) Interviews with employers, union officials, and others closely associated with an industry or occupation; (2) reports of professional and trade associations and licensing agencies; and (3) labor publications, trade journals, annual reports, and related materials.

Methods

Projections of occupational employment are developed as described in chapters 18-20. This broad, systematic framework of projections develops projections of the population, labor force, and national and industry output and employment. For many occupations, employment is projected on the basis of its relationship to certain independent variables rather than on proportional representation in each industry. Projections for these occupations are developed by methods tailored to fit the available data and the nature of the occupation under study. For example, employment for elementary school teachers is projected based on trends in pupil-teacher ratios applied to projected school attendance. Projections developed through these independently conducted analyses are then integrated with other occupational data in the matrix.

Projections of changes in employment by occupation provide only one part of the information needed on job openings in the years ahead. In most occupations, the majority of job opportunities arise either as a result of the transfer of experienced workers to other occupa-

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How accurate were projections of the 1980 labor force?

All four Bureau of Labor Statistics projections, the first in 1965 and the last in 1976, were lower than the actual 1980 labor force; most of the discrepancy can be attributed to the underestimation of the participation rates of women

HOWARD N FULLERTON

The final step in the projection process is evaluation. The Bureau of Labor Statistics has always assessed each of its labor force projections, but only the evaluation of the 1975 estimates has been published. The 1970 projections were evaluated by Marc Rosenblum of the City University of New York.[1] Both evaluations concluded that the BLS had underestimated the number of persons in the labor force, with too many men and too few women. Rosenblum also concluded that the BLS estimate of the 1975 labor force would be too low, based on a comparison with projections by Alfred Tella and Thomas F. Dernberg and others.[2] Bureau of Labor Statistics economist Paul Ryscavage confirmed the underestimation of the BLS projections for the 1975 labor force, finding that an earlier projection, made when the program was still in the Bureau of the Census, was more accurate. He also suggested that the projections for 1980 and 1985 would be too low, primarily because of underestimation of female labor force growth. All four of the BLS projections of the 1980 labor force demonstrated the same pattern of lower than actual growth; generally the male labor force was too high and the female labor force was always too low.[3]

Trend, projected, and actual rates

The Bureau of Labor Statistics published four projections of the 1980 labor force.[4] They were general purpose projections prepared using demographic techniques. In 1965, BLS projected a 1980 labor force (including the armed forces) of 100 million; in 1970, of 101 million; in 1973, of 102 million; and, finally, in 1976, of 104 million. (See table 1.) The actual 1980 labor force was 107 million (1970 census weights).

Each estimate of the 1980 labor force overprojected the male labor force and grossly underprojected the female labor force. For example, the 1970 projection had the men's labor force at 64 million; it totaled 62 million in 1980. At the same time, the 1970 projection placed the women's labor force at 37 million; it reached 45 million in 1980.

The most difficult group to project has been women age 25 to 34. In 1965, the 1980 labor force participation rate for these women was projected to be 40.3 percent. In 1970, the rate was estimated to be 46.5 percent; in 1973, 50.2 percent; and in 1976, 57.3 percent. The rate turned out to be 65.3 percent in 1980, or 25 percentage points higher than the 1965 projection.

The next most difficult group to project was women age 35 to 44. Projection errors ranged from 15.2 percent for the 1965 estimate to 7.2 percent for the 1976 estimate.

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The most difficult male labor force group to project is men 55 to 64. The participation rate projected in -65 was 12.3 percent too high, however, the 1976 pro- tion missed by only 1.1 percent. For men 25 to 34, ors ranged from 2.0 percent in the 1965 projection to 0.1 percent in the 1976 projection.

Generally, more accurate projections are made over a ent period. But, how would the projections have ed if they were adjusted for the length of the projec- n span? To find out, we compared historic, projected, d actual growth rates. Historic growth rates use the me number of years back as the projection is forward. r example, the 1965 projection covered 16 years om 1964 to 1980), making 1948 the reference year for e historic growth rate. The following tabulation ows the historic and the projected and actual growth es of the 1980 labor force:

istoric ference year	Year projection was published	Growth rate Historic	Growth rate Projected	Growth rate Actual
48	1965	1.25	1.73	2.14
50 . . .	1970	1.43	1.84	2.38
56 . . .	1973	2.00	1.68	2.28
70	1976	1.97	1.81	2.39

Both the historic and the actual labor force growth es increased between projections, but the projected owth changed only slightly. In effect, the improve- nt in the projections of the 1980 labor force was due the application of the same growth rate to a labor ce that was actually growing faster than anticipated. simple extrapolation made on the basis of the historic wth rate would have increased the accuracy of the 73 and 1976 projections, but not the 1965 and 1970 jections.[5]

There was a steady increase in the discrepancy between actual and projected labor force growth. The successive projected growth rates were less accurate as 1980 approached. The following tabulation presents the change between the historical growth rate and the projected growth rate (projected change), the change between the historical and actual growth rate (actual change), and the difference between the two, which is also the error in the projected growth rate (a plus sign indicates growth was projected to increase from the historical rate; minus indicates that growth was projected to decrease):

Year published	*Projected change*	*Actual change*	*Difference (error)*
1965	+0.48	+0.89	−0.41
1970	+ .41	.95	− .54
1973	−0.32	.28	− .60
1976	−0.16	.42	− .58

Participation rates of groups

How accurate were the projections for individual age-sex groups? Among individual groups, some differences between projected and actual rates leap out, for example those for women age 25 to 34 for all four projections. However, the median of all the differences between the actual and projected rates was zero — the median for men was 1.2 percentage points and for women, −6.0. This was expected because the rates for men have been dropping while those for women have been rising rapidly.

The range of differences between actual and projected participation rates for women was very large. Usual methods for detecting unusually large values, or outliers, detected none. Combining the differences for male

able 1. The 1980 labor force and participation rates, actual and as projected in 1965, 1970, 1973, and 1976

Age	Labor force (in thousands) as projected in —				Actual 1980²	Participation rates as projected in —				Actual 1980²	Difference			
	1965	1970	1973¹	1976¹		1965	1970	1973¹	1976¹		1965	1970	1973¹	1976¹
Total	98,942	100,727	101,809	103,759	106,821	60.4	60.5	60.8	61.6	63.3	−2.9	−2.8	−2.5	−1.7
Men, total	64,381	63,612	62,590	61,548	62,288	80.3	79.2	78.0	76.8	76.8	3.5	2.4	1.2	0.0
16 to 19	4,824	4,895	4,568	5,239	5,191	56.7	56.7	56.0	61.8	61.2	−4.5	−4.5	−5.2	0.6
20 to 24	9,264	8,795	8,852	8,852	9,022	87.2	83.0	83.0	84.1	85.7	1.5	−2.7	−2.7	−1.6
25 to 34	17,590	17,015	17,573	16,525	16,943	96.2	95.0	94.6	94.1	94.2	2.0	0.8	0.4	−0.1
35 to 44	12,284	12,286	11,851	11,870	11,901	96.7	96.1	95.1	94.6	94.6	2.1	1.5	0.5	0.0
45 to 54	10,219	10,382	9,938	9,529	9,909	95.0	94.0	91.6	90.0	90.3	4.7	3.7	1.3	−0.3
55 to 64	8,184	7,849	7,730	7,275	7,186	83.7	80.5	79.1	72.5	71.4	12.3	9.1	7.7	1.1
65 and over	2,296	2,290	2,258	1,880	1,877	21.8	22.0	21.2	18.7	18.3	3.5	3.7	2.9	0.4
Women, total	35,661	37,115	39,210	41,771	44,733	41.9	43.0	45.0	47.7	50.9	−9.0	−7.9	−5.9	−3.2
16 to 19	3,296	3,440	3,960	4,246	4,258	46.6	41.0	45.5	44.6	53.0	−6.4	−12.0	−7.5	−8.4
20 to 24	5,380	5,981	6,502	7,118	7,170	52.6	57.7	63.4	68.4	69.0	−16.4	−11.3	−5.6	−0.6
25 to 34	7,347	8,427	9,750	10,417	11,980	40.3	46.5	50.2	57.3	65.3	−25.0	−18.8	−15.1	−8.0
35 to 44	8,286	8,728	8,989	7,628	8,605	50.0	53.3	53.2	58.0	65.2	−15.2	−11.9	−12.0	−7.2
45 to 54	6,875	6,719	6,537	6,639	6,973	59.5	55.2	56.2	56.6	59.6	−0.1	−4.4	−3.4	−3.0
55 to 64	5,237	5,103	5,257	4,529	4,581	47.3	45.0	44.7	45.6	41.1	6.2	3.9	3.6	4.5
65 and over	1,369	1,178	1,279	1,737	1,144	9.9	8.5	8.6	11.7	7.6	2.3	0.9	1.0	4.1

¹ Middle scenarios.

² The 1980 labor force data are based on 1970 census weights.

NOTE: Differences with negative values were projected less than actual; those with a positive value were projected higher than actual.

and female rates does detect some outliers. The rates projected in 1965 and 1970 for women age 25 to 34 were underprojected by 25.0 and 18.8 percent. This group also had the greatest change in labor force participation over the period. One questions if a projected rise in participation of more than 25 percentage points would have been credible in 1965. The changes affecting labor force participation of women—fewer births, fewer marriages, unprecedented inflation, more education—affected women in the 25 to 44 age group the most.

Labor force composition. The projected labor force composition (age-sex structure) is of concern to those using the projections for equal opportunity purposes or for some types of market research. Table 2 shows the projected and actual distribution of the labor force. The actual and projected labor force participation rates for all four projections are illustrated in chart 1. If the projections were perfect, they would be plotted on a straight line with a slope of one (an angle of 45 degrees) going through the origin, which is the line of perfect projection.[6] When the four projections are combined, our hypothesis that the actual and projected fall on the line of perfect projection, or that the composition was correctly projected is rejected. The implication is that the composition of the labor force was poorly projected.

The bars on chart 1 show the means of the actual and projected labor force rates; if the bars were on the line of perfect fit, there would be no bias in the projection. The fit of projected against actual always goes through the point where the two means cross. If the slope of this line is different from the line of perfect fit, the composition has not been accurately projected. If the line is parallel to the line of perfect fit, then it is biased. On the other hand, if the projection is unbiased but the trend has not been accurately projected, the projection line will cross the line of perfect fit where the means cross on the line of perfect forecast.

Assumptions and realities

The Bureau of Labor Statistics' labor force projections have been based on past trends of labor force activity extended forward to particular "target" years. The extrapolated rates (modified when necessary) are then applied to population levels projected by the Bureau of the Census, producing projected labor force levels.

This general approach is essentially supply oriented. Because of this orientation, the characteristics which received the most attention from the analysts were the impact of marital status and the presence of children on the labor force activity of women and the impact of school enrollment on the participation of younger workers. For example, the analysts who prepared the 1965 and 1970 projections considered work and childrearing uncompatible roles. The analysts who prepared the 1973 projections felt that the rapid changes in participation rates would not continue; the analyst who prepared the 1976 projection allowed the rapid changes in female participation rates to continue.[7]

Table 2. Distribution of the 1980 labor force, actual and as projected in 1965, 1970, 1973, and 1976

Age	Projected in				Actual 1980[2]	Difference			
	1965	1970	1973[1]	1976[1]		1965	1970	1973	1976
Men, total	64.1	63.2	61.5	59.7	58.1	6.0	5.0	3.4	1.6
16 to 19	4.8	4.9	4.6	5.0	4.9	-0.1	0.0	-0.3	0.2
20 to 24	9.1	8.7	8.7	8.5	8.4	0.6	0.3	0.2	0.1
25 to 34	17.6	17.7	17.2	16.3	15.9	1.7	1.8	1.4	0.5
35 to 44	12.1	12.0	11.6	11.4	11.1	0.8	0.9	0.5	0.3
45 to 54	10.2	10.0	9.7	9.6	9.4	0.9	0.7	0.4	0.2
55 to 64	8.2	7.8	7.6	7.0	6.7	1.5	1.1	0.9	0.3
65 and over	2.1	2.1	2.0	1.8	1.8	0.3	0.3	0.2	0.0
Women, total	35.9	36.8	38.5	40.3	41.9	-6.0	-5.0	-3.4	-1.6
16 to 19	3.3	3.4	3.6	4.1	4.1	-0.8	-0.7	-0.5	0.0
20 to 24	5.4	5.9	6.5	6.9	6.7	-1.3	-0.8	-0.2	0.1
25 to 34	7.4	8.4	9.1	10.0	11.1	-3.8	-2.8	-2.0	-1.1
35 to 44	6.4	6.7	6.7	7.4	8.1	-1.7	-1.4	-1.3	-0.7
45 to 54	6.8	6.2	6.4	6.4	6.5	0.3	-0.3	-0.1	-0.2
55 to 64	5.3	5.1	5.0	4.5	4.3	1.0	0.8	0.7	0.2
65 and over	1.3	1.2	1.2	1.7	1.1	0.3	0.1	0.1	0.6

[1] Middle scenarios.

[2] The 1980 labor force data are based on 1970 census weights.

It will be helpful to review the changes in marital status, presence of children, and educational attainment that have occurred since 1965. While such a discussion will not explain the projection errors, it will indicate whether the underlying supply assumptions of the four BLS projections were met.[8]

Fertility. Births, which peaked in 1958 with a total fertility rate of 3.8 children per woman, dropped during the 1960's, turned up slightly at the end of the decade, and then dropped until 1976, when fertility rates were below those of the Great Depression. Since then, the rate has risen slowly. The decline in fertility was not anticipated and is an important factor in the underprojection of the labor force activity of women. The negative relationship between fertility and participation lessened, which also was not anticipated. These assumptions by the BLS projectionists were not different from those of other projectionists.

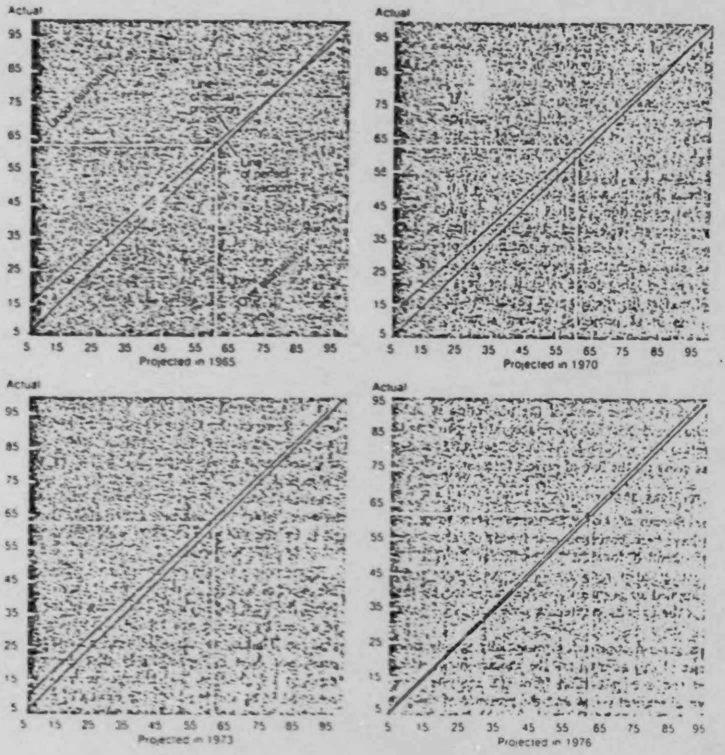
Three points should be remembered when considering the effect of fertility on the labor force status of women. First, the total fertility rate—the sum of the birth rates in a year by specific age groups—overstates the actual changes. That is, no cohort of women averaged 3.8 children, nor does it appear likely that the average will drop to 1.7 children. The changes in fertility were accomplished by shifting both the timing of marrying and of giving birth.[9] It appears that 20 to 30 percent of recent generations of women will not have children.[10] Second, the direction of causality between births and labor force activity is ambiguous. Both are affected by similar

:ors, such as education, inflation, and the changing ·ial expectation. Increased labor force participation · induce tastes that are incompatible with mother-·d. Third, there is a direct effect on labor force par-·pation in that childbirth generally results in the ·ther withdrawing from the labor force, even if for a ·rt time.

Marital status. The changing marital status of the population also affected the growth of the labor force. Not as many married women lived in traditional (spouse present) households.

There was a small, 3-percent annual change in the proportion of married women over the 15-year-period, but if applied to the 87 million women in 1980 who

Chart 1. Labor force participation rates for 1980, actual and projected in 1965, 1970, 1973, and 1976



were 16 or older, it amounts to almost 3 million fewer married women. This shift in the proportion of married women resulted in a greater number of women in the labor force, and was reinforced by the increase in the participation rates of married women. The drop in the proportion of married women reflects the "marriage squeeze," the increased divorce rate, and the postponement of marriage. (Marriage squeeze refers to the joint effect of increasing births and the marriage of women to men about 2 years older. About 20 years after the period of increasing births, there would be fewer men than women of marriageable age.) These factors also lowered the birth rate and the proportion of women with young children.

Parental status. As the proportion of women with young children dropped (as the lower fertility rates implied), their share of the labor force rose. The 1965 projection did not assume growth in the labor force participation of mothers of young children and also did not expect births to drop to such a low level. The 1970 projection also did not explicitly include these assumptions. The 1973 and the 1976 projections attempted to project the number of women with young children by using the current population projections of births. However, both projections overestimated the proportion of mothers of young children and, thus, underprojected the growth of the labor force. The implicit assumption in each projection of the size of the negative relationship between the presence of young children and the labor force activity of their mothers was another factor in the underprojection of the labor force activity of women with young children. In addition, it is more difficult to project marital and parental status than labor force status.

Education. American workers steadily increased their years of formal schooling between 1965 and 1980. This behavior was explicitly modeled in the 1965 and 1970 projections and implicitly assumed in the 1973 and 1976 projections. As education increases, the labor force participation of women also increases.[11]

Inflation. Price changes affect many aspects of economic and social life and, thus, would be expected to have some effect upon labor force activity. Certainly, the projectionists made no explicit assumptions about the rate of price increase, but its effect on participation has been explored by many.[12] Valerie K. Oppenheimer suggested that wives participate more actively in the labor force to maintain family spending because real earnings of the husband remain constant while the family life-cycle requires increasing real income. James E. Duggan found that increased participation of wives is partly caused by the uncertainty engendered by rapid rates of price change. Thus, the rapid price changes of recent years probably contributed to the larger than anticipated labor force growth.

To summarize the assumed versus actual experiences affecting the 1980 labor force, fertility was lower than anticipated, resulting in higher female participation than projected; the lesser rate of withdrawal by women to tend young children also meant higher participation. The proportion of women living with their spouses dropped, which would tend to make female participation rise. We cannot evaluate how well this was anticipated in 1965 because of data limitations; since 1970, it has not been formally a part of the "model." The number of years of schooling completed rose and, for women, so did participation.[13] Finally, the unprecedented rise in inflation was not anticipated and probably resulted in more wives actively seeking work.

Comparison with other projections

In 1977, Data Resources, Inc., projected that the civilian labor force would increase to 102,500,000 in 1980, or 1.95 percent per year.[14] By comparison, in 1976, BLS projected a civilian labor force of 101,600,000 in 1980, a growth rate of 1.86 percent per year. The 1980 labor force was 104,700,000, a 2.46-percent growth rate.

Data Resources projection had a somewhat smaller error (−.51 percent) than the BLS projection (−.60 percent), and, of course, was made a year later. Table 3 compares the projected civilian labor force rates of Data Resources and BLS.

Overall, BLS did slightly better at projecting 1980 participation rates than did Data Resources; the mean of the absolute values of the deviations is 2.0 for BLS and 2.5 for Data Resources. Both were good at projecting male rates, but Data Resources was superior at projecting female rates. Interestingly, Data Resources was

Table 3. Comparison of Data Resources and BLS projections of 1980 civilian labor force participation rates

[In percent]

Age	Projection		Actual	Errors	
	Data Resources	BLS		Data Resources	BLS
Women					
16 to 17	45.3	43.1	43.8	1.5	-.7
18 to 19	62.5	60.0	62.1	.4	-2.1
20 to 24	68.3	68.4	69.0	-.7	-.6
25 to 34	62.4	57.4	65.4	-3.0	-8.0
35 to 44	60.1	58.3	65.5	-5.4	-7.2
45 to 54	55.7	57.1	59.9	-4.2	-2.8
Men					
16 to 17	50.3	50.6	50.1	.2	.5
18 to 19	66.5	71.5	71.5	-5.0	0
20 to 24	81.6	84.2	86.0	-4.4	-1.8
25 to 34	93.1	95.2	95.3	-2.2	-.1
35 to 44	94.0	95.5	95.5	-1.5	0
45 to 54	89.9	91.2	91.2	-1.3	0

Note: These rates do not reflect any adjustment for the 1980 census.

much better at projecting rates for women age 25 to 34 (estimating rates for this age group has always been difficult for BLS). Also, Data Resources' worst projection, that for women age 35 to 44 years, was still better than any of the BLS projection rates for women. Among women, only for those age 16 and 17, and 45 to 54, did BLS have lower projection errors than Data Resources. Among men, the Data Resources projection was better than the BLS projection only for those 16 to 17 years. The feat of projecting some of the rates for men exactly should be discounted, indeed the Data Resources error of 0.2 percentage point should be considered equivalent to an exact projection. In general, the superior projection made by one projecting group for a sex was offset by the errors made in projecting rates for the other group.

Guidelines for users

The labor force projections are prepared for a variety of users. Within the Bureau of Labor Statistics, they are an input into the employment, output, and occupational projections; they are also used in employment and training policy development, in market research, in equal employment opportunity work, and by many States as inputs into State labor force and population projections.[15] It is not clear what level of accuracy is satisfactory—we presented several measures of errors; the user of the projections should select the measure most relevant to the specific application.

There are occasions when the levels or accuracy described here are not sufficient (for example, when the range of uncertainty exceeds the usual levels of unemployment).

If the projections are to be used in simulations concerning unemployment, they should be used with great caution. Nathan Keyfitz commented that the errors in population projections over a 20-year span are sufficiently wide as to limit their usefulness; labor force projections are even more constrained.[16]

Most users tolerate a lower accuracy in long-run than in short-run projections because of their different purposes, and because decisions based on long-run projections can be revised or shifted over time. For example, the decision to build or to not build a sewage treatment facility does not depend on the accuracy of the population projected for a locality, but rather on the likelihood of the population exceeding a specific number. If the facility is built and the population does exceed the threshold number, then the projection was useful even if it was not accurate.[17]

If the future labor force could be determined with no error, it would not be necessary to revise projections. Four comments should be helpful. First, at the time each of the four projections was made the assumptions about the future of the labor force were reasonable. Second, none of the projections has any turning points, it is quite likely that some of the labor force series will indeed change direction. Third, as Henri Theil points out, projections must at some place in their structure hold change constant, whether it is the level of net migration or the rate of change; this has the effect of underestimating the amount of change.[18] Further Jacob Mincer and Victor Zarnowitz say that it is harder to project a rising level of activity.[19] These tendencies results in overestimate of the level of men's labor force activity and underestimate of the activity of women. The relative sizes of the two components of the labor force is more poorly projected. ☐

FOOTNOTES

Marc Rosenblum, "On the accuracy of labor force projections," *Monthly Labor Review*, October 1972, p. 22–29.

Alfred Tella, "Labor Force Sensitivity to Employment by Age, Sex," *Industrial Relations*, February 1965, and Thomas F. Dernberg, Kenneth Strand, and Judith Dukler, "A Parametric Approach to Labor Force Projection," *Industrial Relations*, October 1966.

Labor force projections are used in preparing employment, output, and occupational projections. The Bureau's occupational projections for 1980 are evaluated by Max L. Carey and Kevin Kasunic, in "Evaluating the 1980 projection of occupational employment," *Monthly Labor Review*, this issue, pp. 22–30.

See the following *Monthly Labor Review* articles: Sophia Cooper and Denis F. Johnston, "Labor Force Projections for 1970–80," February 1965, p. 129–39 (reprinted as Special Labor Force Report 49); Sophia Cooper Travis, "The U.S. labor force: projections to 1985," May 1970, pp. 3–12 (reprinted as Special Labor Force Report 119); Denis F. Johnston, "The U.S. labor force: projections to 1990," July 1973, pp. 3–13 (reprinted as Special Labor Force Report 156); and Howard N Fullerton and P.O. Flaim, "New labor force projections to 1990," December 1976, pp. 3–13 (reprinted as Special Labor Force Report 197).

Michael A. Stoto, "The Accuracy of Population Projections" (Laxenburg, Austria, International Institute for Applied Systems Analysis, 1979). Stoto also found that over the first 10 years of a population projection, the naive extrapolation method was more accurate than other methods.

For more information on this type of comparison, see Henri Theil *Economic Forecasts and Policy* (Amsterdam: North-Holland Publishing Co., 1965), and *Applied Econometric Forecasting* (Chicago: Rand McNally and Co., 1966).

The 1965, 1973, and 1976 projections each looked at specific population groups (for example, mothers of young children), thus it should be possible to partition the error in the labor force projection into that due to the size of a specific group and that due to the projection of labor force rate. However, the archives for the labor force projections are not available, and we can only look at the overall error for the major group.

Only 1965 projections considered the effects of a drop in the unemployment rate (to 3 percent); it concluded that for every 3 jobs created 2 would be filled by the unemployed and one by new labor force entrants. Attempts to prove the effect symmetric were unsuccessful, so it is not possible to conclude what effect the higher unemployment rate would have had on the labor force.

Arthur A. Campbell, "Beyond the Demographic Transition," *Demography*, 1974, pp. 549-61, and "Baby Boom to Birth Dearth and Beyond," *Annals*, American Academy of Political and Social Sciences, January 1978, pp. 40-60.

David E. Bloom, "What's Happening to the Age at First Birth in the United States? A Study of Recent White and Nonwhite Cohorts," a paper presented at the 1981 meetings of the Population Association of America.

Although increases in educational attainment of the population were considered in making labor force projections, the Bureau's two projections of the educational attainment of the labor force were made by forcing the overall labor force projections to the Census Bureau's educational attainment projection for the population.

See, for example, Valerie K. Oppenheimer, "The Life-Cycle Squeeze: The Interaction of Men's Occupational and Family Life Cycles," *Demography*, 1974, pp. 227-45; James E. Duggan, "Inflation, uncertainty, and labor force participation," Bureau of Labor Statistics, 1979, and "The Labor Supply of Married Persons: Evidence from the Current Population Survey," Bureau of Labor Statistics, 1981.

Reasons for the decrease in male participation rates are not explored in this article. For an analysis, see William V. Deutermann, Jr., "Another look at working-age men who are not in the labor force," *Monthly Labor Review*, June 1977, pp. 9-14.

James Yrshus and Roger Brinner, "Labor force growth to 1990: The impact of changing social roles," *DRI Long Term Review*, Winter 1977, pp. 92-100.

See Ronald E. Kutscher, "New economic projections through 1990—an overview," *Monthly Labor Review*, April 1979, pp. 9-17.

Nathan Keyfitz, "The Limits of Population Forecasting," *Population and Developments Review*, December 1981, pp. 579-93.

Nathan Keyfitz, *Applied Mathematical Demography* (New York, John Wiley and Sons, 1977).

Henri Theil, *Applied Econometric Forecasting*

Jacob Mincer, and Victor Zarnowitz, "The Evaluation of Economic Forecasts," in Jacob Mincer, ed. *Economic Forecasts and Expectations: Analysis of Forecasting Behavior and Performance* (New York, National Bureau of Economic Research, Columbia University Press, 1969), pp. 3-46.

A note on communications

The *Monthly Labor Review* welcomes communications that supplement, challenge, or expand on research published in its pages. To be considered for publication, communications should be factual and analytical, not polemical in tone. Communications should be addressed to the Editor-in-Chief, *Monthly Labor Review*, Bureau of Labor Statistics, U.S. Department of Labor, Washington, D.C. 20212.

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valuating the 1980 projections
f occupational employment

b projections prepared by BLS in 1970
oved slightly less accurate than estimates
1965-75; classification changes again
stricted comparability, permitting analysis
fewer than half of 160 occupations

x L. CAREY AND KEVIN KASUNIC

w reliable were the 1980 occupational employment
jections? The Bureau of Labor Statistics' estimates
e on target for professional and service occupations,
two fastest growing occupational groups between
0 and 1980.[1] The projections were fairly accurate for
n, craft, clerical, and sales occupations. For the re-
ning three major occupational groups, BLS projec-
s missed the mark by significant margins. BLS
erestimated employment growth for managerial and
inistrative occupations and for nonfarm laborers,
le overestimating employment in operative occupa-
s.

mong individual occupations, the projections
ed accurate for optometrists, physicians, veterinari-
elementary schoolteachers, police, and welders. Op-
unities for lawyers and psychologists grew faster
anticipated. In a seeming anomaly of the im-
ding "cashless so[illegible]ty," cashiers and bank tellers
d count on ma[illegible] more jobs than BLS projected,
e the number of credit managers was less than an-
ated.

s expected, projections for specific occupations were
accurate than for the major occupational groups.
pite some refinements, the 1980 projections were not
e as accurate as the 1975 estimates, which also
ned 10 years.[2]

In evaluating the 1980 projections, comparability again proved to be a major problem. Fewer than half of the detailed occupations studied in the base year could be evaluated, specifically, only 64 of 160 occupations.

Results by occupational group

Among the nine major occupational groups, projection errors were relatively large for nonfarm laborers, managers and administrators, and operatives. The number of nonfarm laborers employed in 1980 was underprojected by 17 percent, and the number of managers and administrators, by 13 percent. (See table 1.) By contrast, operative employment was overprojected by 11.8 percent. The average of the absolute percentage errors for all groups was 6.7 percent.

The direction of employment change was not correctly anticipated for nonfarm laborers and operatives. The number of nonfarm laborers was projected to be 3.7 million in 1980, or about 1 percent lower than the 1970 level. Instead of declining, employment in this group increased to almost 4.5 million. This projection was probably influenced by the trend of the 1960's, when employment remained at about the same level. Conversely, operative employment was projected to rise from 13.9 million in 1970 to 15.4 million in 1980, but declined to 13.8 million. The 1.6-million overestimate of operatives was the largest error in number for a major occupational group. Operative employment is concentrated in manufacturing industries, which are sensitive to economic fluctuations. After recovering from the re-

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of Occupational Outlook, Office of Economic Growth and Em-
ent Projections, Bureau of Labor Statistics

cession of the mid-1970's, operative employment had grown steadily and might have reached the projected level if the economy had continued to improve. Employment was at 14.5 million in 1979. The direction of employment change was correctly anticipated for managers and administrators, but employment grew twice as rapidly as projected, resulting in a 1.4-million underestimate of the 10.9 million employed in 1980. The projection of managers was probably influenced by the employment trend in 1962–67, when employment only grew from 7.4 million to 7.5 million, with very little fluctuation during that period.

Projection errors in the remaining groups were comparatively small. Differences between projected and actual employment levels ranged from less than 1 percent for professional and technical workers and service workers to 6.7 percent for salesworkers. Moreover, the projected and actual amounts of change were very close in some occupations. The estimated increase in professional and technical workers was only 2.5 percent lower than the approximately 4.5-million increase that occurred, and the estimated growth in service workers was only 3.1 percent greater than the actual increase of 3.2 million. The projections correctly identified the professional and technical workers, service workers, and clerical workers as the three fastest growing groups.

Results by specific occupation

Differences between projected and actual employment in the 64 detailed occupations ranged from an underestimate of 47 percent for psychologists to an overestimate of 89 percent for locomotive engineers' helpers. (See table 2.) The absolute percentage errors for all 64 occupations averaged 22.4 percent. About one-half of the occupations had errors lower than the average. Absolute errors ranged from a 444,000-underestimate of cashier employment in the target year to a 181,000-overestimate of telephone operators.

Employment was overprojected in slightly more than one-half of the occupations; on average, by 25.8 percent. Among the occupations in which employment was overstated by more than 50 percent were photoengravers and lithographers, patternmakers, airplane mechanics, telephone operators, and credit managers. Employment was underprojected in almost one-half of the occupations. The average underestimate was 19.5 percent. Employment in several occupations was underprojected by more than 30 percent, including cooks, bartenders, bank tellers, lawyers, and roofers.

The occupational estimates are products of the projections of industry employment and of industry-occupational staffing patterns. Many of the largest errors resulted primarily from misestimates of industry-occupational staffing patterns. The decline in the ratio of telephone operators to total employment in the telephone industry, for example, was greater than anticipated, and consequently the demand for workers in this occupation was overprojected. Staffing pattern estimates also led to large errors in the projections for locomotive engineers' helpers, psychologists, credit managers, lawyers, and roofers. Misestimates of industry employment totals, rather than industry staffing patterns, were the primary causes of large errors for some occupations. The banking industry, for example, grew much more rapidly than expected, resulting in an underprojection of the demand for bank tellers. Projection errors for cooks, bartenders, and aircraft mechanics also were largely a result of poor projections for the industries in which these workers were concentrated.

Size makes a difference

Projection accuracy was related to size of employment. When weighted by employment in each occupation, the average absolute error drops from 22.4 percent to 14.1 percent, indicating that the largest occupations generally had the more accurate projections. Relatively accurate projections for the following three categories, each with more than 1 million workers in 1980, contributed substantially to the improved results: blue-collar supervisors; elementary schoolteachers, and stenogra-

Table 1. Comparison of projected employment and actual employment in major occupational groups, 1970–80

[Workers in thousands]

Occupational group	1970	1980		Percent change		Difference between projected and actual	
		Projected	Actual	Projected	Actual	Level	Percent
Total	78,627	95,085	97,270	20.9	23.7	-2,185	-2.2
Professional and technical workers	11,140	15,500	15,613	39.1	40.2	-113	-0.7
Managers and administrators	8,289	9,500	10,919	14.6	31.7	-1,419	-13.0
Salesworkers	4,854	5,760	6,172	18.7	27.2	-412	-6.7
Clerical workers	13,715	17,285	18,105	26.0	32.0	-820	-4.5
Craft and kindred workers	10,158	12,240	12,529	20.5	23.3	-289	-2.3
Operatives	13,909	15,440	13,814	11.0	-0.7	1,626	11.8
Nonfarm laborers	3,724	3,700	4,456	-0.6	19.7	-756	-17.0
Service workers	9,712	13,060	12,958	34.5	33.4	102	0.8
Farmworkers	3,126	2,600	2,704	-16.8	-13.5	-104	-3.8

Note: Individual items may not add to totals because of rounding. Percent differences are based on unrounded numbers.

ists, and secretaries. Sampling errors for Cur- lation Survey estimates diminish relatively as ent size increases, so the long-run data for upations would be expected to provide more rends to use in the projections:

er of workers	*Number of occupations*	*Average absolute percent error*
otal¹	64	22.4
n 50,000	18	29.5
o 99,999	9	24.9
to 299,999	14	26.3
to 599,999	11	17.2
and more	12	10.1

direction of employment change between 1970 80 was correctly anticipated for 50 of the 64 de- occupations. Again, results were better in the fields of employment. Less than one-sixth of the ations with more than 50,000 workers in 1970 had tions that were in the wrong direction, compared nore than one-third of the smaller fields. Some of ifferences, however, between projected increases ctual declines, or vice versa, were relatively small.

each occupation in which the direction of em- nent change was correctly anticipated, the percent- of the actual change accounted for by the ction was computed. In about two-thirds of the pations the projections underestimated the employ- change. In the remaining occupations, the projec- overestimated the change.

nployment grew in 46 of the occupations between and 1980 and declined in the remaining 18. In- ses were estimated more accurately than decreases. ections of growth averaged an absolute 16.1 percent ctual employment, while those of loss averaged 38.4 cent off. Employment in two-thirds of growing occu- ions was underestimated. All employment declines er were underestimated or not foreseen at all.

he direction of employment change was correctly cipated for all but two of the growing occupations. e number of elementary schoolteachers increased by out 4 percent, instead of declining by 0.9 percent. welers and watchmakers increased more than 37 per- nt, against a projected 0.9-percent decline.

Occupations with the most rapid growth had the rgest projection errors. Projected 1980 levels for those th employment increases of more than 50 percent be- een 1970 and 1980 averaged 30.1 percent off actual 80 levels. Projection errors averaged only 9.4 percent r occupations with slower growth. Target-year em- loyment usually was underestimated in the fastest- rowing occupations and overestimated in those with he slowest growth. Projections were lower than actual evels in the 15 fastest-growing occupations and higher than actual in 12 of the 15 with the slowest increases.

Decreases were not anticipated in 12 of the 18 occupations that declined in employment. The projections correctly identified weaver, knitter, compositor and typesetter, locomotive engineer's helper, railroad conductor, and brake and switch operator as occupations which would decline in employment, although the rate of decrease was generally underestimated.

Testing for accuracy

One way to judge the accuracy of an occupational employment projection is to determine whether the projection or the base-year employment is closer to the target-year employment. In 45 of the 64 occupations, the projections were closer to the target than base-year employment. In the remaining 19 occupations, the projections either were in the wrong direction or overstated the employment growth by wide margins. Another way to judge projections is to compare them with the results obtained from simple alternative methods. Extrapolations of employment data by simple linear regression would have been an inexpensive and easy way of projecting. Extrapolations based on this simple method were more accurate than the projections for 46 of the 64 occupations.³ Several of the extrapolations, however, missed targets by wide margins, which resulted in a slightly lower weighted error for the projections. The weighted absolute average error was 15.1 percent for the extrapolations, compared to 14.1 percent for the projections. Unweighted errors were about the same for both methods.

The evaluation has focused on differences between projected and actual employment *levels*, rather than differences between actual and projected employment *changes*. Generally, occupations with accurately projected levels also were accurate in terms of the proportion of actual change that was estimated. Comparisons of levels, however, have a conservative bias in that projections for occupations which have relatively little employment change tend to get better marks than those which have the most change, as demonstrated in the following occupations. Employment of psychologists was projected to increase from 33,200 in 1970 to 56,000 in 1980, but actually rose to 106,000, which means that target-year employment was underestimated by 47.2 percent. In contrast, the number of cabinetmakers was projected to increase from 70,000 to 72,700, but rose to 85,000, resulting in an underestimate of 14.5 percent. In terms of the difference between projected and actual employment levels, the projection for cabinetmakers is by far the better of the two. The projection for psychologists, however, accounted for about 31 percent of the employment increase that occurred, while the one for cabinetmakers accounted for only 18 percent. Therefore, if the measure of accuracy is the proportion of actual change that was estimated, the projection for psychologists is better. Both kinds of accuracy are important. The accuracy of level is particularly important, however, because projected levels are used in calculating replacement needs resulting from retirements and deaths.

Rating the handbook ratings

In addition to publication in *Tomorrow's Manpower Needs*, many of the 1980 projections were used as a basis for qualitative descriptions in another BLS publication, the 1972–73 edition of the *Occupational Outlook Handbook*, designed to help young people make career plans. In most cases, the handbook description of employment outlook for an occupation includes a sentence about the expected change in employment through the 1970's. The adjectives used to describe expected changes in employment requirements generally corresponded to these ranges of percent change (increase or decrease): very rapid, 40 or more; rapid, 30 to 39.9; moderate, 15 to 29.9; slow, 5 to 14.9; little or no change, 0 to 4.9. The handbook contained occupational statements for 45 of the 64 occupations for which projections were evaluated, and the standard adjectives were used in describing the outlook in 34 of these statements. Statements on only two occupations, elementary schoolteachers and telephone operators, were incorrect about the direction of employment change. The handbook expected employment in this teaching field to decline slowly, but it showed little or no change. The number of telephone operators was expected to grow slowly instead of declining moderately. The outlook description for telephone operators was misleading, but the one for elementary teachers was not.

The adjectives were on target or only one category off target for about two-thirds of the remaining statements. Rapid growth in surveyor employment was projected, for example, instead of very rapid growth. Adjectives for about one-fourth of the statements were off by two categories, but in some cases it is difficult to determine whether this degree of inaccuracy was misleading. The difference betwen moderate growth and very rapid growth, for example, does not seem as significant as the difference between moderate growth and little or no change. Adjectives for the following occupations were three categories off the mark: jewelers and watchmakers, boilermakers, and cement and concrete finishers. The outlook descriptions for these occupations likely were misleading.

The framework

The 1980 projections of occupational requirements were developed within the framework of a 1970–80 matrix that described the relationship of employment in 160 occupations and 116 industries.

The long-term data used in developing the 1970 matrix and projected 1980 matrix were obtained from a variety of sources. The primary sources of data on occupational staffing patterns by industry were the 1950 and 1960 censuses. The primary source of total employment in each industry was the Bureau of Labor Statistics' Current Employment Survey (a payroll survey) for 1947 through 1969. The Current Population Survey (a household survey) was the chief source of total employment of occupational groups and most occupations after 1960. Data for some occupations, however, were obtained from independent sources, such as professional societies and regulatory agencies

The primary data source for occupational employment by industry was the 1960 census, because information from the 1970 census was not available. However, the 1980 data used in the analysis were largely derived from the 1980 Current Population Survey (CPS), which used the 1970 census occupational classification system. Because the Census Bureau revised its 1960 system for classifying employment by occupation for use in the 1970 census, a large proportion of the 160 occupations examined in 1970 were not sufficiently comparable for evaluation.[4]

According to the Census Bureau, all nine occupational groups had 96 percent or better comparability between the two classification systems. Specifically, if the 1960 labor force data were retabulated, 95 percent or more of the employment reported in a particular major occupational group under the 1960 classification system would remain in the same group under the 1970 system, and these workers would represent 95 percent or more of the total for that group. For detailed occupations, there was far less comparability. Of the 297 occupations in the 1960 census classification system, only 171 had 90 percent or better comparability in the 1970 system. About one-half of these occupations, however, were not included in the matrix. In addition, the accuracy of some of the projections that were based on historical data from sources other than the census could not be verified. After eliminating occupations which were less than 90 percent comparable and those which had verification problems, the evaluation of projections was limited to 64 of the 160 detailed occupations covered in the matrix.

In addition to the comparability and verification problems, the comparison of actual and projected data were hampered by the sampling errors of the CPS. For a CPS estimate of 50,000, for example, the standard error would be about 6,700 or roughly 13 percent of the employment level. This much variance would have a great impact on evaluating accuracy, for projections averaged only 28 percent off the CPS-derived 1980 estimates for occupations with employment of less than 100,000.[5]

Data constraints precluded construction of a 1980 trix with actual data comparable to the projected 0 matrix. Consequently, 1980 employment levels for st occupations were estimated from CPS data, the primary source of occupational data for matrices between decennial censuses. Data on 1980 employment were also obtained from independent sources, such as professional associations, in cases where the 1960 and 1970 matrices used these sources rather than the census or CPS.[6]

Table 2. Comparison of projected, simulated, and actual 1980 employment in selected occupations
(Workers in thousands)

Occupation	1970	1980			Difference between projected and actual		Difference between simulated and actual		Percent change		
		Projected	Simulated	Actual	Level	Percent	Level	Percent	Projected	Simulated	Actual
Compositors and typesetters	175.0	165.0	199.5	165.0	0.0	0.0	34.5	20.9	-5.7	14.0	-5.7
Optometrists	17.5	21.0	24.9	20.9	0.1	0.5	4.0	19.1	20.0	42.3	19.4
Delivery, route, and taxi drivers	655.0	750.0	696.7	746.0	4.0	0.5	-49.3	-6.6	14.5	6.4	13.9
Food counter and fountain workers	291.0	411.0	368.4	417.0	-6.0	-1.4	-48.6	-11.7	41.2	26.6	43.3
Blue-collar worker supervisors	1488.0	1700.0	1708.9	1729.0	-29.0	-1.7	-20.1	-1.2	14.2	14.8	16.2
Heat treaters, annealers, and temperers	22.0	24.4	24.7	24.0	0.4	1.7	0.7	2.9	10.9	12.3	9.1
Veterinarians	24.0	33.0	23.3	33.8	-0.8	-2.4	-10.5	-31.1	37.5	-2.9	40.8
Welders and flame cutters	535.0	675.0	616.4	693.0	-18.0	-2.6	-76.6	-11.1	26.2	15.2	29.5
Osteopaths	13.5	19.4	20.1	18.8	0.6	3.2	1.3	6.9	43.7	48.9	39.3
Physicians and surgeons	266.0	395.0	391.5	381.3	13.7	3.6	10.2	2.7	48.5	47.2	43.3
Police and detectives	415.0	600.0	584.7	579.0	21.0	3.6	5.7	1.0	44.6	40.9	39.5
Radio and television repairers	132.0	163.0	148.8	170.0	-7.0	-4.1	-21.2	-12.5	23.5	12.7	28.8
Elementary schoolteachers	1260.0	1249.0	1856.7	1313.0	-64.0	-4.9	543.7	41.4	-0.9	47.4	4.2
Furnace tenders, smelters, and pourers	60.0	64.0	63.3	61.0	3.0	4.9	2.3	3.8	6.7	5.5	1.7
Plumbers and pipefitters	350.0	470.0	439.4	444.0	26.0	5.9	-4.6	-1.0	34.3	25.5	26.9
Railroad conductors	40.0	39.0	31.3	36.7	2.3	6.3	-5.4	-14.7	-2.5	-21.8	-8.3
Electricians	440.0	585.0	534.7	625.0	-40.0	-6.4	-90.3	-14.5	33.0	21.5	42.0
Machinists and related workers	585.0	660.0	671.8	616.0	44.0	7.1	55.8	9.1	12.8	14.8	5.3
Stenographers, typists, and secretaries	3504.0	4580.0	4418.2	4963.0	-383.0	-7.7	-544.8	-11.0	30.7	26.1	41.6
Molders, metal, except coremakers	56.0	62.5	62.3	58.0	4.5	7.8	4.3	7.4	11.6	11.3	3.6
Dentists	96.7	127.6	144.1	118.3	9.3	7.9	25.8	21.8	32.0	49.0	22.3
Meatcutters and butchers, except meatpackers	190.0	200.0	214.4	185.0	15.0	8.1	29.4	15.9	5.3	12.8	-2.6
Carpenters	830.0	1075.0	1079.9	1172.0	-97.0	-8.3	-92.1	-7.9	29.5	30.1	41.2
Railroad brake and switch operators	88.0	85.0	70.2	78.2	6.8	8.7	-8.0	-10.2	-3.4	-20.2	-11.1
Mail carriers, post office	254.0	320.0	315.8	357.2	-37.2	-10.4	-41.4	-11.6	26.0	24.3	40.6
Registered nurses	688.7	983.0	984.6	1101.0	-118.0	-10.7	-116.4	-10.6	42.7	43.0	59.9
Waiters and waitresses	1040.0	1240.0	1225.3	1413.0	-173.0	-12.2	-187.7	-13.3	19.2	17.8	35.9
Millwrights	80.0	94.0	88.7	108.0	-14.0	-13.0	-19.3	-17.9	17.5	10.9	35.0
Cabinetmakers	70.0	72.7	84.6	85.0	-12.3	-14.5	-0.4	-0.5	3.9	20.9	21.4
Shipping and receiving clerks	379.0	430.0	437.9	505.0	-75.0	-14.9	-67.1	-13.3	13.5	15.5	33.2
Postal clerks	300.0	385.0	372.9	456.3	-71.3	-15.6	-83.4	-18.3	28.3	24.3	52.1
Mechanical engineers	206.7	276.8	253.2	232.0	44.8	19.3	21.2	9.1	33.9	22.5	12.2
Firefighters	180.0	275.0	251.2	227.0	48.0	21.2	24.2	10.7	52.8	39.6	26.1
Aeronautical engineers	63.9	77.6	72.9	64.0	13.6	21.3	8.9	13.9	21.4	14.1	0.2
Civil engineers	179.9	235.6	245.7	192.0	43.6	22.7	53.7	28.0	31.0	36.6	6.7
Locomotive engineers	43.0	43.0	34.7	34.2	8.8	25.7	0.5	1.5	0.0	-19.3	-20.5
Surveyors	51.2	68.2	74.8	93.0	-24.8	-26.7	-18.2	-19.6	33.2	46.1	81.6
Dietitians and nutritionists	30.0	37.4	42.0	51.0	-13.6	-26.7	-9.0	-17.6	24.7	40.0	70.0
Jewelers and watchmakers	35.0	34.7	37.6	48.0	-13.3	-27.7	-10.4	-21.7	-0.9	7.4	37.1
Guards	373.0	425.0	507.9	589.0	-164.0	-27.8	-81.1	-13.8	13.9	36.1	57.9
Boilermakers	24.0	26.5	26.5	37.0	-10.5	-28.4	-10.5	-28.4	10.4	10.4	54.2
Cashiers	847.0	1110.0	984.4	1554.0	-444.0	-28.6	-569.6	-36.7	31.1	16.2	83.5
Cement and concrete finishers	65.0	90.0	86.1	70.0	20.0	28.6	16.1	23.0	38.5	32.5	7.7
Chemical engineers	50.9	59.3	58.4	46.0	13.3	28.9	12.4	27.0	16.5	14.7	-9.6
Plasterers	35.0	40.0	46.4	31.0	9.0	29.0	15.4	49.7	14.3	32.6	-11.4
Postmasters and assistants	35.0	35.0	43.5	27.1	7.9	29.2	16.4	60.5	0.0	24.3	-22.6
Cooks, except private household	740.0	930.0	922.5	1335.0	-405.0	-30.3	-412.5	-30.9	25.7	24.7	80.4
Asbestos and insulation workers	25.0	34.0	30.8	49.0	-15.0	-30.6	-18.2	-37.1	36.0	23.2	96.0
Crane, derrick, and hoist operators	145.0	179.0	162.1	137.0	42.0	30.7	25.1	18.3	23.4	11.8	-5.5
Weavers, textile	60.0	50.0	57.1	38.0	12.0	31.6	19.1	50.3	-16.7	-4.8	-36.7
Bank tellers	225.0	337.0	269.7	506.0	-169.0	-33.4	-236.3	-46.7	49.8	19.9	124.9
Photographers	65.0	72.0	87.6	111.0	-39.0	-35.1	-23.4	-21.1	10.8	34.8	70.8
Bartenders	160.0	200.0	185.5	311.0	-111.0	-35.7	-125.5	-40.4	25.0	15.9	94.4
Lawyers and judges	286.9	342.0	381.5	539.0	-197.0	-36.6	-157.5	-29.2	19.2	33.0	87.9
Roofers and slaters	60.0	76.0	78.8	124.0	-48.0	-38.7	-45.2	-36.5	26.7	31.3	106.7
Knitters, loopers, toppers	47.5	46.0	44.9	33.0	13.0	39.4	11.9	36.1	-3.2	-5.5	-30.5
Inspectors, log and lumber	20.0	23.0	21.2	16.0	7.0	43.8	5.2	32.5	15.0	6.0	-20.0
Psychologists	33.2	56.0	47.6	106.0	-50.0	-47.2	-58.4	-55.1	68.7	43.4	219.3
Photoengravers and lithographers	34.0	50.0	38.3	32.0	18.0	56.3	6.3	19.7	47.1	12.6	-5.9
Patternmakers, metal and wood	43.0	56.8	50.7	36.0	20.8	57.8	14.7	40.8	32.1	17.9	-16.3
Airplane mechanics and repairers	140.0	194.3	172.6	121.0	73.3	60.6	51.6	42.6	38.8	23.3	-13.6
Telephone operators	420.0	480.0	497.0	299.0	181.0	60.5	198.0	66.2	14.3	18.3	-28.8
Credit managers	68.0	100.0	80.5	54.0	46.0	85.2	26.5	49.1	47.1	18.4	-20.6
Locomotive engineers' helpers	17.2	14.0	13.4	7.4	6.6	89.2	6.0	81.1	-18.6	-22.1	-57.0

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Methods and assumptions. The basic approach used to estimate future occupational employment requirements was to project total employment by industry, project occupational staffing patterns (ratios) by industry, and then multiply the industry totals by the ratios to obtain occupational estimates. The results were then summed across industries to obtain occupational totals.

Projections of the occupational structure of each industry were based on examination of historical statistics and the analysis of the factors that influence occupational structure changes, such as new technology and changes in the product mix of industry. Employment requirements for many occupations, however, were projected independent of their relationships to industry employment. The projection of schoolteachers, for example, was based on an analysis of trends in pupil-teacher ratios and the projected school-age population. This technique was preferred in cases where such reliable predictive relationships could be established.[7]

The 1980 occupational projections embodied certain assumptions about the size of the labor force, Armed Forces strength, the rate of unemployment, and other selected assumptions. Full employment was assumed in the target year and defined as a civilian labor force with a 3-percent unemployment rate. A total labor force of 100.7 million was projected for 1980, and it was assumed that 2.7 million persons would be in the Armed Forces, yielding a civilian labor force of 98 million. With the assumed unemployment rate, the result was projections of 95.1 million employed and 2.9 million unemployed workers. The employment number was used as a control total for the occupational projections.

Total employment underestimated

The projection of total employment for 1980 was 2.2 percent below the actual 97.3 million. Ironically, the error would have been greater if either the labor force or the unemployment rate had been accurately projected. The labor force projection was 5.7 percent lower than the actual 106.8 million, primarily because the number of women entering the labor force was greater than anticipated.[8] In addition, Armed Forces strength was overprojected by 600,000. The net result was a 6.7-million, or 6.4-percent, understatement of the civilian labor force (workers in thousands):

Labor force group	*Projected*	*Actual*	*Percent difference*
Total	100,700	106,821	-5.7
Armed Forces	2,700	2,102	28.4
Civilian labor force	98,000	104,719	-6.4
Employment	95,085	97,270	-2.2
Unemployment	2,915	7,448	-60.9

The unemployment rate in 1980 averaged 7.1 percent, instead of the assumed 3 percent. Consequently, the number of unemployed workers was underestimated by about 4.5 million. In terms of employment, however, this error offset a large part of the error in the civilian labor force projection. If the civilian labor force had been projected correctly, the unemployment assumption would have resulted in a 4.4-percent overstatement of 1980 employment, rather than the 2.2-percent underestimate that occurred. Conversely, if the unemployment rate had been accurately anticipated, the civilian labor force projection would have resulted in a 6.4-percent understatement of employment.

The recovery and expansion that followed the 1974–75 downturn came to an end in 1980, as the economy felt the effects of the 1979 oil-price shock. After declining from 8.5 percent in 1975 to 5.8 percent in 1979, the unemployment rate rose to 7.1 percent in 1980. Even if the economy had continued to improve, however, it is not likely that unemployment would have declined to the 3-percent rate assumed in the projections. The economic downturn of 1980 affected employment in some occupations more than others. Because unemployment rates for individual occupations were not specified in the assumptions, however, the effect of economic conditions on the accuracy of a projection for any given occupation is difficult to measure.

Simulated projections

A simulated matrix based on projected 1980 industry employment totals and 1970 staffing patterns for each industry was developed to determine whether these base-year patterns would have resulted in better or worse occupational employment estimates than the projected patterns that were used. Neither was clearly superior, but the 1980 estimates for many occupations changed substantially.[9]

The projections were more accurate than the simulations for 6 of the 9 major occupational groups. (See table 3.) However, the average absolute error for all groups declined from 6.7 percent to 5.7 percent as a result of the simulations. The improvement in this average was largely because of a much more accurate estimate for nonfarm laborers. Employment in this group was projected to increase less than 1 percent between 1970 and 1980, but actually rose 19.7 percent. The simulated estimate was very close to actual employment. Simulations also were more accurate than projections for managers and farmworkers.

The simulation improved the projection accuracy for exactly one-half of the 64 detailed occupations in the study and reduced it for the remainder. (See table 2.) The average absolute percentage error increased slightly, from 22.4 percent to 22.9 percent. Errors from the simulation ranged from a 55-percent understatement of psychologists to a 81-percent overstatement of locomotive engineers' helpers. The same occupations had the most extreme errors in the projections, and the values

Table 3. Comparison of projections and simulations of 1980 employment by occupational group

[Numbers in thousands]

Occupational group	1980			Difference between projected and actual		Difference between simulated and actual	
	Projected	Simulated	Actual	Level	Percent	Level	Percent
Total	95,085	95,085	97,270	-2,185	-2.2	-2,185	-2.2
Professional and technical workers	15,500	15,117	15,613	-113	-0.7	-496	-3.2
Managers and administrators	9,500	9,910	10,919	-1,419	-13.0	-1,009	-9.2
Salesworkers	5,760	5,541	6,172	-412	-6.7	-631	-10.2
Clerical workers	17,285	16,763	18,105	-820	-4.5	-1,342	-7.4
Craft and kindred workers	12,240	12,143	12,529	-289	-2.3	-386	-3.1
Operatives	15,440	15,830	13,814	1,626	11.8	2,016	14.6
Nonfarm laborers	3,700	4,377	4,456	-756	-17.0	-79	-1.8
Service workers	13,060	12,695	12,958	102	0.8	-263	-2.0
Farmworkers	2,600	2,709	2,704	-104	-3.9	5	0.2

Note: Detail not add to totals because of rounding. Percent differences are based on unrounded numbers.

were about the same. However, nsiderable differences ppear when the occupations are ranked according to ccuracy. Only two occupations were among the 10 ith the most accurate projections in each version. ven among each top 20, there were only nine occupaions in common. Similarly, only two occupations were mong the 20 with the worst projections in each version.

The simulation increased projection errors substanially for several occupations. One of the better rojections, a 5-percent underestimate of elementary choolteachers, was raised to a 41-percent overestimate. ecause these teachers declined as a percentage of total mployment in the educational services industry beween 1970 and 1980, the use of 1970 staffing patterns the matrix resulted in an overstatement of employent.[10] Some other occupations with much less accurate rojections as a result of the simulation were veterinarins, optometrists, compositors and typesetters, and ostmasters. In contrast, projection errors were reduced gnificantly in several occupations, including credit anagers, airplane mechanics, photoengravers and lihographers, and locomotive engineers. Many of the ccupations most affected by the simulation were conentrated in relatively small numbers of industries, thus educing chances of compensating errors in industry-ocpation cells in the matrix.

Similar patterns were observed in both the projecons and the simulations. The largest occupations nerally had the most accurate 1980 estimates. In each se, the direction of employment change was correctly ticipated in about 5 out of every 6 occupations. Emoyment in about two-thirds of the growing occupaons was underestimated, and nearly all employment clines were underestimated.

The simulation exercise indicated that the extrapolan of staffing patterns did not, on average, produce ore accurate projections for detailed occupations than e assumption that the patterns would not change over the projection period. This suggests that future work should concentrate on analysis of factors that affect the patterns, rather than extrapolations based on limited observations.

Projections for 1975

The 1980 occupational projections were slightly less accurate than those previously developed by the Bureau for 1975. The 1980 estimates have the disadvantage of being based on more dated statistics on occupational staffing patterns of detailed industries as the 1960 census was the most recent source for both projections. However, a larger number of CPS annual estimates of total employment in each occupation was available for the 1980 projections.

Although the 1975 projections were published with a 1960 matrix base, CPS estimates of annual employment were available annually through 1965 at the time the projections were being developed and were used in the analysis. Annual CPS estimates through 1970 were available for the 1980 projections. Therefore, both the 1975 and 1980 projections covered a 10-year span.

The projection of total civilian employment in 1975 was 2.9 percent higher than the actual level of 84.8 million. The 1980 projection, by contrast, was 2.2 percent lower than the actual level of 97.3 million. The difference is explained primarily by the underlying labor force projections. In both periods, labor force participation rates for women rose more rapidly than expected, resulting in underestimates. However, the labor force was underestimated by only 2.3 percent in 1975, compared with 5.7 percent in 1980. For each year, it was assumed that Armed Forces strength would be 2.7 million and the unemployment rate would be 3 percent. The number of military personnel was overestimated by about 24 percent in 1975 and by more than 28 percent in 1980. The economic recession of the mid-1970's negated the assumption of a full-employment economy in 1975. The unemployment rate in 1975 averaged 8.5 percent, or almost triple the assumed rate. Although the downturn in 1980 was not as severe, the unemployment rate averaged 7.1 percent.

Among the comparable detailed occupations, the 1975 projections averaged 21.1 percent off the mark, while the 1980 estimates averaged 22.4 percent off. Accuracy improved, however, for about one-half of the occupations. The largest error among the 1975 projections, a 136-percent overestimate of plasterers, was reduced to 29 percent. Large projection errors for civil engineers and knitters, loopers, and toppers also were reduced. Occupations with worse projections in 1980 included airplane mechanics, lawyers, telephone operators, locomotive engineers' helpers, and crane, derrick, and hoist operators.

Only two occupations were among the 10 with the most accurate projections for each year. Among the leading 20, there were eight occupations in common. In addition, relatively few of the same occupations were among the least accurate projections for each year.

Again, similar patterns were observed in both sets of projections. The largest occupations usually had the most accurate projections. The direction of employment change was correctly anticipated for about 5 out of every 6 occupations in each set. In both the 1975 and the 1980 projections, errors for occupations that declined in employment averaged more than twice as high as those with employment growth. Nearly all employment declines were underestimated. However, employment in about one-half of the growing occupations was underprojected in 1975, compared with two-thirds in 1980.

The 1975 projections performed better against simple extrapolations than the 1980 projections, but the extrapolations for these two target years were not based on the same number of employment observations. For the 1975 study, annual employment data were available only for 6 years, whereas most of the extrapolations to 1980 were based on 9 years of data.

The earlier evaluation did not include a simulation of target-year employment using base year occupational staffing patterns and projected industry employment totals. Instead, it focused on a simulation based on projected staffing patterns and actual 1975 employment totals for each industry, which disclosed that errors in the occupational employment projections were mostly a result of the staffing patterns. Unfortunately, data limitations precluded a similar study of the 1980 projections.

New projections

Since the 1980 projections were published, the Bureau has taken steps to improve its occupational outlook program. Recently, the first matrix to be developed from data from the Occupational Employment Statistics survey was completed and projected to 1990.[11] Previous matrices were based largely on census information on trends in staffing patterns from decade to decade. Because census data are collected only once every 10 years, they do not capture the latest developments in occupational employment requirements in different industries. The occupational employment survey provides much more timely information, as it collects data on a 3-year cycle. The survey also is more specific in its definition of occupations and has a larger sample than the census-derived sample.[12]

Both this study and that of the 1975 projections indicated weaknesses in industry-occupation staffing patterns. The evaluation of the 1980 projections disclosed that mechanical extrapolation of staffing patterns in the matrix does not necessarily produce better results than static patterns. In preparing the 1990 survey-based projections, patterns were extrapolated only when detailed analysis showed that there were reasons to expect them to change. As a result, the matrix has more industry-occupation cells that remain static between the base and target years.

The 1980 projections were based on a single set of assumptions. Three alternative sets of occupational employment projections were developed for 1990 from different assumptions about growth of the labor force, production, productivity, and other factors. While many users of the data may prefer a single set of estimates, the Bureau's evaluations have demonstrated a wide range of errors in previous occupational projections. In addition, a single estimate concerning the future inevitably causes users to attribute a precision to it that should not be afforded. Alternatives also are of more value to planners who are concerned with how differences in the assumptions might affect the demand for some occupations more than others. ☐

—— FOOTNOTES ——

[1] The Bureau's occupational projections for 1980 were published in *Tomorrow's Manpower Needs*, Volume IV, revised 1971, Bulletin 1737.

[2] See Max L. Carey, "Evaluating the 1975 projections of occupational employment," *Monthly Labor Review*, June 1980, pp. 10-20.

[3] CPS annual averages of employment for 1962 through 1970 were extrapolated for the 51 occupations which use the Census and CPS as data sources for the matrix. Twelve other occupations had matrix estimates based on independent sources. Rather than attempting to reconstruct annual data from independent sources, estimates from 1960 and 1970 matrixes were extrapolated for these occupations. An extrapolation was not developed for osteopaths because an estimate for this occupation was not available from the 1960 matrix. The extrapolation for locomotive engineers' helpers resulted in negative employment in 1980; the negative number was arbitrarily adjusted to a positive level of 100 workers.

Technical Paper 26 1970 Occupation and Industry Classification System in Terms of Their 1960 Occupation and Industry Elements (Washington, U.S. Bureau of the Census, 1972.)

e formula and parameters established from the CPS were not ped specifically for use in identifying standard errors of employ- in detailed occupations, but, nevertheless, should approximate agnitude of error.

or some occupations, the 1970 matrix employment levels and CPS employment levels were identical. In these cases, the 1980 employment was accepted without adjustment. For many other pations, however, differences existed between CPS and matrix em- ment levels for 1970, even though the matrix estimates were not oped from independent sources. If a difference was large, the oc- ion was not included in the evaluation. The 1980 CPS employ- t levels were adjusted to account for small differences in the 1970 bers from the CPS and the matrix. If matrix employment for an pation in 1970 was 2 percent higher than CPS employment, for ple, the 1980 CPS employment was increased by 2 percent. A ar procedure was followed in preparing employment estimates data obtained from independent sources.

For a detailed discussion of the methodology used in developing loyment projections, see *Tomorrow's Manpower Needs*, pp. 3–6.

The total labor force participation rate for women was projected 3.0 percent for 1980. See "The United States economy in 1980," *thly Labor Review*, April 1970, pp. 3–34. The labor force partici- on rate for women in 1980 was actually 50.9 percent. For an eval- on of the 1980 labor force projections, see Howard N Fullerton, w accurate were projections of the 1980 labor force?", elsewhere hi issue.

Other simulations based on different combinations of actual and cted data on staffing patterns and industry employment totals would have been interesting. The occupational totals resulting from a matrix based on 1970 staffing patterns and actual 1980 industry employment levels could be compared with the actual 1980 occupational totals to determine the extent to which static patterns alone would have affected projection accuracy. Similarly, simulations could be developed by combining actual 1980 staffing patterns with projected 1980 industry employment, and projected 1980 staffing patterns with actual 1980 industry employment. These two simulations could be used to determine whether the projections of staffing patterns or the projections of industry employment contributed most to the projection error for each occupation. Unfortunately, some of the data needed for these studies were unavailable. The Current Population Survey (CPS), which was the primary source of data on total employment by detailed occupation for 1980, gives staffing patterns only for industry groups. The Bureau's establishment survey, which is the source of data on wage and salary employment in each industry, changed from the 1967 Standard Industrial Classification (SIC) to the 1972 SIC in 1978, and, consequently, projected and actual employment levels for 1980 are not comparable for many industries.

Actually, the 1970 staffing patterns for elementary schoolteachers were not the sole source of the overprojection of employment in the simulated matrix. The error was compounded by an overprojection of total employment in the educational services industry for 1980. If the industry projection had been correct, the overprojection of elementary teachers would have been reduced by more than one-third.

See Max L. Carey, "Alternative occupational employment projections, 1980–90," *Monthly Labor Review*, August 1981, pp. 42–55.

For a description of the survey, see *Occupational Employment Statistics Handbook*, Bureau of Labor Statistics, April 1979.

An evaluation of BLS projections of 1975 production and employment

An unexpected recession accounted for much of the large error in projected output, biasing equations for demand and resulting in overprojections of employment; weaknesses in the estimation process also contributed

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The Bureau of Labor Statistics' projections of the 1975 economy, prepared in 1971, were designed to reflect steady medium-term growth—not the sharp deviation from the growth path brought on by the 1974–75 recession.[1] Thus, the high-productivity, full-employment assumptions of the 1975 projections resulted in a large percentage error in "supply gross national product (GNP)," the projected level of economic resources. This error, in turn, biased the equations of the econometric model used for estimating levels of demand and passed high projections for the categories of final demand through the projection process, ultimately distorting projected levels of industry employment.

Bureau evaluation of its projection methodology also revealed weakness in the estimation of demand components of GNP. Equations used to derive the investment and import levels were found to be particularly poor, while equations related to personal income, personal consumption expenditures, and government purchases performed well. The final demand industry distributions were quite inaccurate, due mainly to judgmental error. Errors in industry outputs were due mainly to errors in final demand and not to inaccuracies in the input-output table employed in the projection process. However, industry productivity factors also were wide of the mark, offsetting the demand error to produce spurious accuracy in the industry employment projections.

Projections of the labor force and employment in 1975 fell within 4 percent of the realized levels. Estimated GNP was overprojected by 15.4 percent. The projection errors for detailed industry final demand, output, and employment fell along a broader range, but, for the most part, the larger percentage errors occurred among the smaller sectors.

Employment was overestimated for three-quarters of the industries studied. The largest percent errors occurred within the durable manufacturing and mining industries, while the largest numerical errors occurred within the construction, trade, and service industries; the service, trade, and durable manufacturing industries are the three largest employers. The absolute difference between actual and projected employment for each of the 71 industries studied averaged 81,099 jobs, or 8.0 percent of total employment for these industries.

The 1975 projections were developed by the Bureau as part of a contract with the U.S. Arms Control and Disarmament Agency to study the economic impact of a military withdrawal from Vietnam. This article evaluates all aspects of those projections. However, because, by definition, projections offer a plan for, not a forecast of, the economy and cannot anticipate cyclical or short-term fluctuations, this evaluation will focus mainly on the assumptions made and the projection

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process employed, rather than on the differences between the actual and projected values.

Groundwork for projection

Three alternative sets of projections were prepared; common among them was the assumption of a withdrawal of U.S. Armed Forces from Vietnam by 1972. The first set contained a defense spending assumption lower than the 1968–69 level but somewhat higher in real terms than the pre-Vietnam level. This "basic model" also assumed that the housing goals of the Housing and Urban Development Act of 1968 would be met.[2] The second set of projections, the "environmental model," contained higher pollution abatement expenditures, which raised nonresidential construction, producers' durable equipment, and State and local government spending; these were offset by lower housing expenditures. The third alternative contained lower defense expenditures under the assumption of an arms limitation agreement. To focus on the central framework of the 1975 projections, the assumptions and structure of only the basic model will be evaluated in this article.

Procedural path. Briefly, the 1975 projections were developed through the following steps:

1. Assumptions about aggregate employment, hours worked, and labor productivity were used to determine an aggregate potential GNP figure for 1975. Because it was derived from the economic resources projected to be available, this figure is termed "supply GNP."

2. Additional assumptions about population, government, and the corporate and consumer sectors were used to drive the demand-oriented equations of a macroeconometric model. This model projected subaggregates of demand, including personal consumption expenditures, government expenditures, investment, and imports; together they equal "demand GNP."

3. Each of these demand subaggregates was broken down by industry and fed into an input-output matrix which translated demand into industry output.

4. Projected employment-output ratios were used to convert industry outputs into detailed industry employment requirements.

Target output overshot

The projection of supply GNP began with the derivation of employment from assumptions about the labor force, labor force participation rates, and the unemployment rate for the target year. Employment was combined with projected annual hours per employee to provide an estimate of total annual hours worked. This figure, multiplied by output per hour—the aggregate productivity of labor—yielded an estimate of the potential gross national product (GNP).

Employment growth was projected to slow from its Vietnam-war rate of 2.9 percent per year to the prewar trend rate of 1.4 percent. Productivity gains were expected to counter this slowdown, and, combined with a 3.8-percent unemployment rate, raise GNP 4.4 percent annually from 1969 to a 1975 level of $935.0 billion (1958 dollars). (See table 1.) The estimate exceeded by 15.4 percent the actual 1975 GNP of $810.0 billion.[3]

The most important factor in this error was the 9-percent overestimation of output-per-hour in the private nonagricultural sector. In projecting this variable,

Table 1. Determination of supply GNP, 1969 and 1975, and selected trends

Component	1969	1975			Trend		
	Actual	Actual	Projected	Percent error	Actual 1969–75[1]	Projected 1969–75[2]	Actual 1950–68
Total labor force (thousands)	84,239	94,793	92,792	-2.1	2.1	1.6	1.7
Civilian labor force	80,733	92,539	90,292	-2.5	2.3	1.8	1.6
Unemployed	2,831	7,830	3,431	-56.2	10.4	3.3	-4.4
Employed	77,902	84,801	86,861	2.4	1.9	1.8	1.8
Employment (thousands of jobs)	82,674	88,833	91,861	3.4	1.6	1.8	2.1
General government	11,264	13,636	13,535	-.7	2.8	3.1	4.6
Private	71,410	75,197	78,326	4.2	1.4	1.6	1.7
Average annual hours per worker, private	1,980	1,918	1,976	3.0	-.5	-.1	-.3
Private GNP per hour (constant 1958 dollars)	$4.67	$5.17	$5.63	8.9	1.8	3.2	3.3
Gross government product (billions of 1958 dollars)	$80.7	$84.3	$85.3	1.2	1.6	1.2	3.8
GNP (billions of 1958 dollars)	$724.7	$810.0	[3]$934.7	15.4	2.6	4.4	4.0

[1] Actual annual 1969–75 and actual annual 1950–68 trends are shown as least squares growth rates.
[2] Projected 1969–75 trends are shown as compound growth rates.
[3] Projected GNP is shown as derived by the analysis; for publication it was rounded to $935.0.

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the high-capacity, slow productivity-change period of 1965–69 was compared with the higher post-World-War-II trend in productivity growth. Output was expected to rise enough to recover the slowdown from the Vietnam years and combine with a fully utilized labor force to ensure a growth in productivity of 3.3 percent by 1975. This growth rate was not expected to be sustained, rather, productivity change was seen to be limited over the long run by employment shifts to the lower productivity service sector.

In fact, productivity did grow at a 3-percent annual rate in 1971 and 1972; it slowed thereafter, dropping by 3.5 percent in 1974. Though production began to fall in mid-1974, firms were uncertain of the extent of the decline and retained workers until the beginning of 1975. Production reached a cyclical trough in the second quarter of 1975, and layoffs increased. Productivity, therefore, rose, but only enough to result in a 1975 gain of 1.8 percent.

The second major factor accounting for the overestimation of supply GNP was the projected unemployment rate. This assumption is linked with projected productivity: both were chosen to be consistent with long-run full employment growth. The projected economy was assumed to be expanding toward reasonable full employment, resting on a 3.8-percent unemployment assumption. However, unemployment rates rose above this level as early as 1970 and, coupled with an expanding labor force, reached a postwar high of 8.5 percent in 1975.

A related error, in the opposite direction, was the underestimate of the total labor force for 1975. The labor force was projected to be 92.8 million in 1975, 2.1 percent below the actual labor force of 94.8 million. The chief cause of the underestimate was the error in projecting female labor force participation rates; 42.5 percent of the female noninstitutional population were expected to hold jobs, while 46.4 percent actually did so.[4]

The persons-to-jobs adjustment factor, designed to account for multiple jobholding and other conceptual differences between the count of persons employed and jobs held, was 25 percent higher than the actual 1975 level; it was responsible for 5.8 percent of the GNP error in 1975. This error and that in the total labor force were offset by the error in the assumed unemployment rate, bringing projected civilian employment within 3.4 percent of the realized level.

The last major error in projecting supply GNP was the overprojection of average annual hours. Because of expected increases in part-time employment at the expense of full-time hours, annual hours for the nonfarm economy were projected to decline slowly from 1969 to 1975 at 0.1 percent per year. In reality, layoffs and other employment effects of the recession slowed annual hours to a 0.5-percent decline over that period.

Table 2. Factored errors in the computation of supply GNP, 1975

Item	Level[1]	Difference from actual	Percent distribution of error
Projected supply GNP	$936.7	$126.7	100.0
Projected total labor force	790.3	-19.7	-15.5
Projected unemployment	853.9	43.9	34.7
Projected adjustment factor	819.8	9.8	7.7
Projected military employment and compensation	808.1	-1.9	-1.5
Projected Federal Government employment and compensation	809.9	-.1	-.1
Projected State and local government employment and compensation	810.8	.8	.6
Projected average annual hours	832.7	22.7	17.9
Projected GNP per hour, private agriculture	810.9	.9	.7
Projected GNP per hour, private nonagriculture	874.6	64.6	51.0
Projected gross government product	811.0	1.0	.8
Net interaction effect	814.7	4.7	3.7

[1] Reflects the calculation of potential GNP with the projected value of an individual variable and the actual values from all other variables in the GNP equation.

Table 2 contains a detailed analysis of the errors committed in projecting supply GNP. Each entry in the "level" column reflects the calculation of potential GNP with the projected value of the individual variable and the actual 1975 values from all other variables in the GNP equation. The GNP level derived thus reflects the error due to the individual component. For example, when the projected unemployment rate was combined with the actual level of the labor force, the actual adjustment factor, actual government employment, actual annual hours worked, and actual productivity, a supply GNP level of $853.9 billion resulted. This level is $43.9 billion greater than the actual GNP for 1975, so the error in the projected unemployment rate accounted for 34.6 percent of the total error in projected supply GNP.

Deficiencies in projected demand

The components of demand GNP (output required to fill the consumption needs of the public, government, and industry) provide the link between the supply GNP aggregate and the more detailed breakdown of each demand category by industry. These components include personal consumption expenditures (PCE), investment, government purchases, and foreign trade. The determination of components in previous projection efforts by BLS relied on analysts' judgment and interpretation of trends. The 1975 projections employed a macroeconometric model developed by Lester C. Thurow to allocate the supply GNP estimate among the demands of consumers, businesses, government, and the foreign sector.[5]

The Thurow model consists of 40 behavioral equations and identities whose results are aggregated to produce value estimates for each demand component of GNP. These equations depend on 57 variables whose values must be supplied to the model. These assumed values—known as "exogenous" variables—thus form the basis of the model's solution. They include structural assumptions which define the level of the economy's capital stock, the characteristics of the population, and the level of prices among components of GNP.

To identify weak or faulty equations, the Thurow model was solved for each year 1970–75, using actual values for each of the exogenous variables. This simulation analysis showed that the income equations in the Thurow model were well-suited for use in projection over the 1970–75 period. (See appendix.) Errors in these variables can largely be ascribed to incorrect exogenous variables. Equations in the corporate and investment blocks of the model appear to be relatively insensitive to their explanatory variables, however, and suffer from specification and estimation bias. Even if the analysis had had perfect foresight in the choice of investment-block exogenous variables, significant projection errors would result. A similar description fits the imports equation. The only government demand equation, for State and local government purchases, appears to be affected by nonrandom bias in the simulation period and, though its error is small, may benefit from reestimation.

With this description of relative equation errors, we can begin to concentrate on the usefulness of the model variables that were used to balance the demand and supply side GNP estimates. These variables are called "policy variables." They include the unemployment rate (generally fixed at the outset), Federal Government purchases, Federal transfer payments, and the corporate profits tax rate. Using the Thurow model simulation as a starting point, five additional solutions were made: one for each policy variable under study. For each run, the associated policy variable was changed by a standard 10 percent in a direction counter to its 1975 projection error. For example, corporate profits taxes were projected 12.5 percent above what actually occurred; thus, in one solution, this variable was lowered 10 percent closer to the actual level.

Each endogenous component of demand GNP then was compared with its base case level. None of the demand policy variables had impacts large enough to shift the components to their actual 1975 levels. Correct projection of any of the demand policy variables would have little improved GNP component projections. For example, a 30-percent increase in projected government transfer payments would have been on target for 1975 but would still have left a 10-percent error in personal consumption expenditures because of inaccuracies in the equation used to project that component of GNP. Similarly, a correct projection of the interest rate on Treasury bonds would improve the residential investment component only to a 30-percent error for 1975. However, although the impact of policy variables on component values was relatively small, it was large enough in some cases for the important task of a demand GNP model—affecting the percent distributions of GNP among components.

Table 3 shows the comparative distributions for the actual, projected, and simulated demand GNP components. The projected distribution was relatively far from actual, reflecting a large investment sector (16.6 percent of GNP) relative to the realized investment share of 11.8 percent. None of the policy variable changes came close to reproducing the share of State and local government purchases, even with large levels of Federal

Table 3. Comparative demand GNP by percent distribution, 1975

[In percent]

Item	Actual 1975	Projected 1975	Base case[1]	Alternative simulations[2]				
				Federal grants-in-aid[3]	Interest rates	Government transfers to persons	Tax rate, corporate profits	Tax rate, median family income
Demand GNP	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Personal consumption expenditures	68.1	66.7	67.8	67.6	68.2	68.0	67.8	67.8
Investment in nonresidential structures	2.5	3.2	3.7	3.7	3.7	3.8	3.7	3.7
Investment in producers' durable equipment	7.6	8.3	6.4	6.4	6.4	6.3	6.5	6.4
Investment in residential structures	2.7	4.4	3.4	3.3	2.9	3.4	3.4	3.4
Change in business inventories[4]	-1.0	.7	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0
Exports[4]	8.5	7.2	8.5	8.5	8.5	8.5	8.5	8.5
Imports	-6.4	-6.8	-5.7	-5.7	-5.8	-5.8	-5.7	-5.7
Federal purchases[4]	4.4	4.7	4.4	4.4	4.4	4.4	4.4	4.4
State and local purchases	5.7	5.5	4.8	4.8	4.9	4.8	4.8	4.8
Government compensation	7.8	7.0	7.8	8.0	7.8	7.8	7.7	7.8

[1] The initial macroeconomic model simulation with the actual 1975 values of all exogenous variables.

[2] The alternative simulations consisted of the base case model solution with a policy variable changed 10 percent in the direction of 1975 assumption error.

[3] To State and local governments.

[4] Exogenous variable.

grants-in-aid. Manipulation of long-term interest rates and government transfer payments brought PCE close to the mark, however. In addition, the long-term interest rate assumption had enough marginal impact to bring residential investments' share close to the actual.

What can be learned from these simulations and policy variable impacts? We know that the income equations of the Thurow model were well-specified, and, thus, that errors in projections of personal consumption expenditures were due to exogenous assumptions. Investment-related equations simulated poorly, so the error due solely to assumptions could not be ascertained. Imports also simulated poorly, but their share of GNP was little affected by policy variable manipulation. No policy variable proved to be significant enough to balance the model, but a combination of policies toward government transfers, long-term interest rates, and grants-in-aid could have had the impact necessary to achieve reasonable target levels for the consumer and government components of GNP. The analysts appeared to have little control over the investment and foreign sectors once an income policy was set.

Industry outlook errors

The final product of the projection process was an estimate of employment by industry for 1975. To this end, control totals for the various categories of "final demand"—personal consumption expenditures, producers' durable equipment, residential and nonresidential structures investment, inventory change, net exports, Federal Government expenditures, and State and local government expenditures—were taken from the Thurow model. Analysts distributed each total among 87 industries, creating a "bill-of-goods" for each final demand component. These were consolidated into a total final demand bill-of-goods and combined with a projected input-output matrix; the result was a level of output for each of 82 industries,[8] the total production required by each industry to meet projected final demand. When these outputs were multiplied by a set of employment-output ratios, or productivity factors, projected employment by industry resulted.

Errors in these employments can, therefore, be attributed to three major causes: errors in the projected final demands, errors in the projected input-output tables, and errors in the projected employment-output ratios. In this section, these error sources will be explored.[9]

Final demand. The projection of final demand by industry can be distorted by two factors: errors in the macro projection which serves as a control total for a particular category of final demand and errors in the distribution of final demand among the detailed industries. The control totals were taken from the demand GNP sector of the macro model and are, therefore, susceptible to the gamut of errors discussed in the first part of this article. The industry distributions of final demand were projected separately for each category of final demand based on past trends and expected changes to these trends. The distributions were not totally independent of the control totals that were projected.

The control totals, passed through from the macro model, were the most important source of error in the projection of the final demand bills-of-goods. This conclusion is drawn from the comparison of the bills-of-goods generated from the projected control totals and the actual industry distributions with the total final demand bill-of-goods that actually resulted in 1975. Among industries, the average absolute weighted projection error in final demand was 17.6 percent; the error resulting when only the controls were projected was 16.5 percent. In contrast, the distribution error—the error that results when actual controls are combined with projected industry distributions of final demand—averaged 10.1 percent. Thus, to some extent, the errors are reinforcing. If either the control totals or the distributions of final demand had been projected correctly, the projections would have been improved.

Industry-level projections of final demand suffered wide deviations from actual values, as shown in table 4. In most industries, these deviations among components of final demand were offsetting; some, however, were not. Final demand for the output of the mining industry was overestimated for each category. Manufacturing, transportation, and government enterprise final demand also were consistently overestimated. Final demand for agricultural products was, on balance, closely projected, but its two major sources of demand—personal consumption expenditures and net exports—were underestimated. When projected distributions were scaled by actual control totals, as shown in table 4, all but three industries improved. These industries—agriculture, communications, and trade—were the three most accurately projected industries. If controls had been correctly projected, durable manufacturing, public utilities, and the service industry would have been the most accurately projected.

The industry sectors that showed the largest percentage errors in final demand were durable manufacturing, construction, and nondurable manufacturing. These sectors accounted for more than two-thirds of the total absolute error in projected final demand. Demand for durable goods is most sensitive to cyclical fluctuations, as a recession forces consumers and businesses to postpone major purchases until more stable times. Federal Government demand for durables also was hard hit, partially as a result of the earlier-than-projected reduction in defense activities. Demand for services and nondurables usually are less affected by a recession than is demand for durables. However, they were still subject

Table 4. Composition of final demand by major industry group, 1975

[Billions of 1958 dollars]

Group	Projected	Actual	Projected distribution	Projected	Actual	Projected distribution	Projected	Actual	Projected distribution
	Total final demand			Personal consumption expenditures			Gross private domestic investment		
Total	984.5	810.0	810.0	614.0	561.0	561.0	150.0	95.3	95.3
Agriculture	9.7	9.4	8.2	5.7	5.8	5.1	.3	−.3	−.6
Mining	1.5	.8	1.2	.2	.1	.2	.1	−.3	−.1
Construction	101.3	64.3	88.7	0	0	0	70.1	39.6	61.3
Manufacturing	357.7	294.1	304.6	208.0	181.5	187.0	71.2	40.1	45.2
Durables	191.5	154.3	157.4	67.8	57.7	61.0	69.6	40.8	46.8
Nondurables	166.2	139.8	147.3	140.2	123.8	126.0	1.0	−2.7	−1.6
Transportation	30.8	29.9	29.6	18.5	11.1	16.8	2.1	.9	1.2
Communications	15.7	15.8	14.0	12.7	13.3	11.4	1.3	1.0	1.0
Public utilities	22.1	20.3	19.9	19.5	17.4	17.0	0	0	0
Trade	142.2	141.0	127.2	120.7	120.1	118.7	9.6	7.6	6.7
Services	270.5	229.4	197.4	223.2	182.8	184.6	2.1	2.6	1.2
Government	3.4	3.0	3.0	2.1	1.2	1.9	0	0	0
Other	29.3	25.0	28.0	13.4	10.6	12.0	−1.0	−1.5	−.6
	Net exports			Federal Government			State and local government		
Total	4.0	17.2	17.2	68.5	56.4	56.4	95.0	89.2	89.2
Agriculture	3.7	6.7	3.0	−.4	−2.0	−.4	.2	.2	.2
Mining	1.0	.9	1.0	.2	.1	.1	(1)	(1)	(1)
Construction	(1)	(1)	(1)	4.0	4.5	3.2	27.2	20.2	24.2
Manufacturing	38.4	35.4	37.1	28.9	22.9	25.6	13.2	8.3	11.7
Durables	26.1	24.6	24.6	25.0	19.2	20.4	5.1	4.0	4.6
Nondurables	12.3	10.8	12.5	3.9	3.8	3.2	8.0	4.3	7.2
Transportation	5.7	5.6	5.8	1.9	1.6	1.5	1.9	1.5	1.7
Communications	.3	.2	.3	.4	.6	.3	1.0	.8	.9
Public utilities	.1	.1	.1	.1	.3	.1	2.4	2.5	2.2
Trade	3.8	4.0	3.9	1.0	1.3	.8	.2	0	.2
Services	3.0	2.0	3.1	4.7	5.7	3.8	5.5	12.5	4.9
Government	.1	.1	.2	.6	.3	.5	.5	.5	.5
Other	−30.3	−37.8	−32.0	30.3	21.9	22.9	42.8	42.7	42.7

[1] Less than $50,000,000.

to significant projection errors in this study.

Output. Projection errors among the final demand categories and in the input-output matrix combined to yield an average absolute percentage error in output per industry of 23 percent. Though this error is quite large, it is slightly biased: some of the worst projections were made in sectors that accounted for small shares of total output. When each error was weighted by its sector's output share, average absolute projection error declined to 13.5 percent. The output errors ranged from −21.3 percent for farm machinery to 72.0 percent for ordnance. Half of the industries, accounting for over two-thirds of output, suffered absolute errors of less than 18 percent. New construction, the fourth largest industry in terms of total output, accounted for the largest portion of the total absolute output error—almost 12 percent. This overestimation is attributable to the error in projecting the residential and nonresidential construction controls. The second largest portion of output error was accounted for by the wholesale and retail trade sector. Final demand for trade was closely projected; the error was due to errors in the entire final demand bill-of-goods and its interaction with the input-output matrix.

Because an actual 1975 input-output matrix was not available for this evaluation, a classical factor analysis of output errors was not possible.[8] However, an attempt was made to isolate somewhat the effects of errors in each of the two elements of industry output projection: final demand and the input-output matrix. To isolate the effect of the projected input-output matrix, the matrix was multiplied by the actual 1975 final demands, and the resultant set of outputs was compared with actual and projected outputs. It was found that the average weighted absolute error dropped to 10.0 percent from 18.5 percent when actual final demands were used. The error due to final demands and their interaction with the projected input-output matrix averaged 19.1 percent. Thus, the larger part of the error in industry outputs was due to errors in the final demands.

Employment. For 1975, total employment was overprojected by about 3.5 percent. Some industries showed overprojections of as much as 20 percent, while others were underprojected. (See table 5.) In general, the overprojection of GNP led to an overprojection of industry outputs; together with the misprojection of labor productivity, this led to the overprojection of industry employment.

At the industry level, the average absolute percentage error in employment for 71 industries[9] was 14.8 percent; when weighted by industry employment shares, the average dropped to 8 percent. This indicates that the larger percentage errors were in the smaller industries. More than 40 percent of the industries, accounting for more than two-thirds of employment, had been projected within 10 percent of the actual. (See table 6.) The largest single concentration of error was in the construction industry; personal and business services were a close second. The third largest source of error was the trade sector—although the projection error was small, it became important because of the large size of the sector.

If it had been possible to project industry outputs correctly, employment would have been underprojected by an average of 4.5 percent for the 71 industries because of misprojected productivity. The average absolute error would have been 12.5 percent for the industries; but, when weighted by employment shares, it would have risen to 13.5 percent. Thus, the productivity factors were projected more closely for the smaller industries. More than half of the industries would have been projected within 10 percent of actual if the actual outputs had been correctly projected; these industries account for only one-third of total employment. The error in the trade sector caused by the misprojection of the productivity factor accounted for 40 percent of the error caused by employment-output ratios. The construction industry and business services industry also were large contributors to the error.

If the productivity factors had been forecast accurately, employment would have been overprojected by an average of more than 19 percent. The average absolute error for the 71 industries would have been 23.2 percent, with a weighted average of 19.3 percent. Only one-quarter of the industry projections were within 10 percent of actual; these industries accounted for slightly more than 28 percent of employment. Trade was responsible for the largest single amount of error caused by the output errors, contributing one-quarter of the total. Construction accounted for one-fifth of the error; business and personal services accounted for one-tenth.

Table 5. Comparison of employment by major industry group, 1975

(In thousands)

Group	Projected		Actual		Percent difference
	Level	Percent distribution	Level	Percent distribution	
Total	91 430	100.0	88 253	100.0	3.5
Agriculture	3 350	3.7	3 400	3.8	-1.5
Mining	625	.7	623	.7	[illegible]
Construction	5 100	5.6	4 472	5.1	14.0
Manufacturing	21 295	23.3	18 632	21.1	14.3
Durables	12 495	13.7	10 863	12.3	15.0
Nondurables	8 800	9.6	7 769	8.8	13.3
Transportation	3 000	3.3	2 788	3.2	7.6
Communications	1 210	1.3	1 190	1.4	.9
Public utilities	725	.8	745	.8	-2.7
Trade	18 940	20.7	19 423	22.0	-2.4
Services	20 400	22.3	20 532	23.2	-.6
Private household	2 240	2.4	1 859	2.1	20.5
Government	14 550	15.9	14 720	16.7	-1.2

In most industries, the errors caused by incorrect productivity factors and outputs were offsetting. In 11 of the 71 industries, these errors were reinforcing. These 11 industries are small, accounting for only about 3.6 percent of employment. The average error of their projected employment was 14.5 percent; the average absolute error was more than 23 percent, and, when weighted by employment, was almost 22 percent. Together, the 11 accounted for 12 percent of the total error.

Thus, for the most part, the larger sectors were more closely projected. Errors caused by incorrect industry outputs and productivity factors were largely offsetting; the weighted absolute errors were smaller for projected employment than they would have been if either industry outputs or productivity factors had been accurately projected.

Another way to evaluate the projections is to compare projected and actual relative trends. Fifty-four industries were projected to experience employment growth, while only 26 did so over the period. Of the 10 projected to grow the fastest, only 2 actually were among the 10 fastest—radio and TV broadcasting and nonprofit institutions. The fastest growing industry, coal mining, was projected to be among the 10 slowest growing. The projections were successful in identifying 5 of the 10 slowest growing industries in terms of employment growth: aircraft, ordnance, communications equipment, leather tanning, and broad and narrow fabrics.

A closer look. Tracing through the errors in several industries might better show the impact of various types of errors in the projection process on the final published estimates. Errors in the projections for the aircraft, construction, and trade industries are typical of those which occurred throughout the projections.

The aircraft industry produces both finished aircraft and aircraft parts. The Federal Government purchases more than half of its final output, and the misprojection of such government purchases was responsible for almost two-thirds of the error in the projection of final demand for the aircraft industry's output. An additional 20 percent of the industry's final demand error was due to the overprojection of private investment purchases of aircraft. Aircraft purchases are large expenditures which are necessarily postponed in economic downturns. As expected, aircraft accounted for less than the projected percentage of the final demand bill-of-goods as a result of 1974–75 recession. This distribution error compounded the error caused by the overprojection of the macro controls. As would be expected, the overprojection of aircraft final demand created an overprojection of industry output; intermediate output for aircraft was not so poorly projected. In fact, the projected input-output matrix actually would have underestimated the intermediate requirements if actual final demand had been projected.

Employment in the aircraft industry declined steadily from 1968 to 1972; the projected level of employment was more in line with what had occurred in the early 1960's. Output was projected to remain almost level between 1969 and 1975, while employment dropped slowly and productivity rose. Instead, output and employment fell at almost the same rate. The 76-percent error in final demand led to a 60-percent error in output; the employment error was 26.5 percent.

The construction industry, which includes new construction and maintenance and repair construction, showed the largest employment projection error of any industry. Most of this error was due to the misprojection of final demand. For new construction, which accounts for more than three-quarters of the output of this industry, final demand is, by definition, equal to output. Maintenance and repair construction is chiefly intermediate output generated through the input-output matrix. Thus, the overprojection of the structures component of investment and State and local government expenditures led to overprojections of final demand, which produced overprojections of output. The

Table 6. Comparison of industry output and employment, 1975

Industry	Output[1]: Run A[2]	Output[1]: Projected	Output[1]: Percent difference	Employment[3]: Projected	Employment[3]: Actual	Employment[3]: Percent difference	Employment growth rate: Run B[4]	Employment growth rate: Percent difference[5]	Employment growth rate: Projected 1969-75[6]	Employment growth rate: Actual 1960-77[6]
Agriculture, mining, and construction										
Agriculture	$56,181	$67,583	-16.87	3,000	3,103	-3.32	3,109	0.19	-2.92	-1.90
Agricultural services, forestry and fishery	2,948	3,174	-7.11	350	297	17.85	322	8.42	.10	4.17
Iron and ferroalloy ores mining	1,415	1,491	-5.36	30	28	7.14	28	0	-.55	.08
Nonferrous metal ores mining	1,081	1,082	-.09	60	64	-6.25	36	-43.75	0	.55
Coal mining	3,248	4,352	-25.33	135	217	-37.79	149	-31.34	-.95	6.02
Crude petroleum and natural gas	12,948	12,383	4.57	270	179	50.84	196	9.50	-1.74	2.94
Nonmetallic mining and quarrying	4,006	4,614	-13.17	125	115	8.70	106	-7.83	.98	.46
Construction	84,130	78,757	6.82	5,100	4,472	14.04	3,253	-27.26	3.28	1.15
Manufacturing										
Ordnance and accessories	5,751	4,599	25.05	225	171	31.58	131	-23.39	-5.85	-7.32
Food and kindred products	83,105	102,238	-18.71	1,800	1,715	4.96	1,820	6.12	-.24	-.61
Tobacco manufactures	6,199	7,862	-21.14	75	79	-5.06	84	6.33	-1.48	-1.43
Broad and narrow fabrics	18,024	16,629	8.39	585	539	8.53	476	-11.69	-.80	-.72
Miscellaneous textile goods	6,271	5,853	7.15	140	125	12.00	112	-10.40	.12	-.89
Apparel	25,353	27,830	-8.90	1,575	1,321	19.23	1,578	19.45	.68	-1.08
Miscellaneous fabricated textile products	4,729	4,976	-4.96	185	171	8.19	183	7.02	.74	.80
Lumber and wood products	11,086	13,879	-20.12	680	631	7.77	613	-2.85	-.22	.60
Household furniture	5,259	4,750	10.72	400	326	22.70	276	-15.35	2.11	1.38
Other furniture and fixtures	2,727	3,070	-11.18	175	134	30.60	129	-3.73	2.49	-.20
Paper and allied products, except containers	18,227	18,182	.25	530	449	18.04	442	-1.56	1.56	-.22
Paperboard containers and boxes	6,956	7,130	-2.43	250	195	28.21	206	5.64	1.40	-1.11
Printing and publishing	25,011	23,250	7.53	1,265	1,107	14.27	1,093	-1.26	1.19	-.15
Chemicals and selected chemical products	27,834	31,577	-11.85	490	467	4.93	445	-4.71	.27	-.23
Plastics and synthetic materials	14,906	21,732	-31.43	275	204	34.80	330	61.76	3.32	-.36
Drugs, cleaning and toilet preparations	15,605	20,738	-24.74	325	283	14.84	336	18.72	2.54	1.33
Paints and allied products	3,085	3,149	-2.03	80	65	23.08	64	-1.54	1.77	-.53
Petroleum refining and related industries	24,399	36,561	-33.26	179	198	-9.57	212	7.07	.18	1.34
Rubber and miscellaneous plastics products	21,318	21,023	1.41	700	592	18.24	579	-2.36	2.99	1.29
Leather tanning and industrial leather products	922	916	.74	25	24	4.17	29	20.83	-4.23	-2.77
Footwear and other leather products	3,731	3,113	19.85	315	235	34.04	255	8.51	0	-3.28
Glass and glass products	4,496	4,436	.98	210	176	19.32	179	1.70	2.24	.19
Stone and clay products	12,238	13,474	-9.17	530	450	17.78	388	-13.78	1.45	-.32
Primary iron and steel manufacturing	29,553	29,988	-1.61	855	941	9.42	752	-16.53	-.39	-1.42
Primary nonferrous metals manufacturing	18,559	15,563	19.25	460	342	34.50	300	-12.28	.73	-1.34
Metal containers	2,674	3,750	-29.58	85	76	11.84	93	22.37	0	-2.12
Heating, plumbing, structural metal products	11,718	11,814	-.81	580	517	12.19	402	-22.24	1.51	.64
Stampings, screw machine products and bolts	6,425	4,847	32.55	385	313	23.00	242	-22.68	.53	-.79
Other fabricated metal products	11,571	12,354	-6.33	535	453	12.27	436	-3.11	.39	.94
Engines and turbines	3,763	4,824	-21.99	115	112	2.68	116	3.57	.59	.40

See footnotes at end of table.

Table 8. Continued — Comparison of industry output and employment, 1975

Industry	Output[1]			Employment[3]			Employment growth rate			
	Run A[2]	Projected	Percent difference	Projected	Actual	Percent difference	Run B[4]	Percent difference[5]	Projected 1968-75[6]	Actual 1968-77[7]
Farm machinery and equipment	4,210	4,779	-11.90	150	151	-.66	181	25.41	1.40	2.28
Construction, mining, and oilfield machinery	6,089	6,891	-11.63	225	254	-11.42	251	-1.18	[illegible]	3.59
Materials handling machinery and equipment	2,191	2,156	1.64	110	91	20.88	74	-18.68	2.84	.55
Metalworking machinery and equipment	6,140	5,667	8.34	375	309	21.36	255	-17.48	.87	.29
Special industry machinery and equipment	3,811	4,357	-12.53	225	182	23.63	166	-8.79	1.32	-1.23
General industrial machinery and equipment	7,130	7,762	-8.14	325	289	12.46	276	-4.50	1.88	.77
Machine shop products	3,557	3,972	-10.45	275	271	1.48	252	-7.01	1.00	1.88
Office, computing, and accounting machines	12,560	12,400	1.29	350	284	23.24	266	-6.34	4.04	1.93
Service industry machines	6,138	6,239	-1.61	170	148	14.86	116	-21.62	2.60	1.82
Electric industrial equipment and apparatus	9,865	9,840	.26	470	395	18.99	367	-7.09	1.34	.18
Household appliances	9,232	8,177	12.91	195	154	26.62	162	5.19	.88	-1.38
Electric lighting and wiring equipment	4,322	3,606	19.86	250	180	38.89	157	-12.78	3.63	-.04
Radio, television, and communication equipment	18,562	18,157	2.23	650	554	17.33	537	-3.07	-.75	-1.94
Electronic components and accessories	12,916	11,314	14.16	415	340	[illegible]	290	-14.67	1.17	.60
Miscellaneous electrical machinery	3,909	3,632	7.64	130	135	-3.70	117	-13.33	1.06	3.08
Motor vehicles and equipment	55,543	47,518	16.89	900	779	15.38	670	-13.98	-.28	-.08
Aircraft and parts	12,142	12,852	-5.50	650	514	26.46	410	-20.02	-3.66	-3.38
Other transportation equipment	6,487	10,080	-35.64	360	373	-3.49	343	-8.04	.76	2.37
Scientific and controlling instruments	7,020	8,195	-14.33	325	308	5.52	319	3.57	.56	1.16
Optical, ophthalmic, and photographic equipment	5,787	7,028	-17.62	200	185	8.11	179	-3.24	3.15	2.02
Miscellaneous manufacturing	10,578	10,248	3.22	500	423	18.20	441	4.26	1.25	-.30
Transportation, communications, public utilities, and trade										
Transportation and warehousing	53,910	60,008	-10.16	3,000	2,788	7.60	2,550	-8.54	.51	-.05
Communications, except broadcasting	29,670	33,451	-11.30	1,050	1,047	.29	1,121	7.07	2.23	.77
Radio and television broadcasting	2,082	2,930	-28.94	160	152	5.26	189	24.34	3.00	2.38
Electric, gas, water, and sanitary services	50,212	47,329	6.09	725	745	-2.68	596	-20.00	1.10	1.30
Wholesale and retail trade	188,089	176,835	6.36	18,940	19,403	-2.39	16,178	-16.62	1.85	2.57
Finance, insurance, real estate, and services										
Finance and insurance	51,683	49,344	4.74	3,500	3,591	-2.53	3,178	-11.50	2.28	2.81
Real estate and rental	131,018	133,154	-1.60	950	992	-4.23	892	-10.08	2.09	2.92
Hotels, personal and repair services	16,516	15,763	4.85	3,190	2,614	22.04	2,183	-16.48	1.00	.95
Business services, research and development	61,334	58,945	4.05	3,550	3,747	-5.26	3,012	-19.62	2.55	4.62
Automobile repair and services	13,581	14,063	-3.48	670	868	-22.81	613	-29.38	3.05	1.73
Amusements	7,513	9,151	-17.90	880	879	.11	935	6.37	1.37	2.04
Medical, educational, nonprofit institutions	51,509	51,840	-.64	7,660	7,841	-2.31	7,211	-8.03	4.22	4.38

[1] Levels in millions of 1958 dollars.

[2] Run A shows output computed using actual final demand bill-of-goods and the projected input-output table.

[3] Levels in thousands.

[4] Run B shows employment computed using actual output and projected employment/output ratios.

[5] Difference between actual employment and employment calculated using actual output and projected [illegible] ratios.

[6] Projected 1968-75 growth rates are compound annual growth rates.

[7] Actual 1967-77 growth rates are least-squares growth rates.

input-output matrix further compounded this problem; actual final demands would have created more output than actually occurred.

Once again, the employment projection was not as poor as the final demand and output projections. The 57-percent error in final demand led to a 57-percent error in output, but the employment projection was only off by 14 percent. Once again, productivity was overprojected. Employment grew between 1969 and 1975, but not nearly as much as projected.

The wholesale and retail trade sector is another industry which showed a large numerical error in its employment projection. Final demand for trade was closely projected. Personal consumption expenditures accounted for over 90 percent of final demand, and was within 1 percent of actual. Overprojection of the macro controls was offset partially by the underprojection of the importance of this industry in the final demand distributions for most final demand categories. The 1.6-percent overprojection of final demand led to a 17-percent overprojection of output. Final demand was projected to decline as a percentage of total output, when in fact it grew. Actual final demands and the projected matrix would have overprojected output; when the overprojected total final demand column was used, this error was compounded.

Employment in trade, as in aircraft and construction, was projected more closely than output; the error was only about 2.4 percent, because of the overprojection of productivity. Both output and employment were projected to grow over the 1969–75 period; their actual growth did not match the projection for either.

For most industries, the employment projection looked reasonable, based on the historical data available at the time of the projections. Adjustments were probably made at other points in the projections process to assure this "believability."

Past evaluation, future benefits

This evaluation differs greatly from the evaluation of the Bureau's projections for 1970,[10] chiefly because a version of the Thurow model could not be assessed for the earlier study. In addition, the 1970 study found productivity factors to be the most important in explaining errors in projected employment, while the 1975 study found macro controls to be the major source.

Since the 1975 projections were published, the Bureau has taken great strides in revamping and enhancing the projections process. Industry detail has been increased, and the historical data base has been broadened. The Federal Government sector bill-of-goods has been expanded to encompass six categories of demand, and the State and local bill-of-goods expanded to 20 categories. The Houthakker-Taylor model of consumption has been reestimated and expanded. Capital flows matrices have been incorporated in the projection system, to allow changing industrial outputs to change the mix of investment goods.

Over the next several years, a further expansion of modeling efforts is planned. The Thurow model and the consumption model will be further updated and expanded, and a State and local model will be added to the system. A Federal Government model and a private construction model are planned. Near-term goals include the introduction of a factor-demands model into the system. These advances are designed to improve the crucial projection of macro controls and their distribution among industries. □

——— *FOOTNOTES* ———

[1] *Projections of the Post-Vietnam Economy, 1975*, Bulletin 1733 (Bureau of Labor Statistics, 1972).

[2] The basic model assumed 2.7 million housing starts in 1975, while the alternatives assumed 2.0 million units.

[3] Data described as "actual" in this article represent the authors' estimate. Due to the conceptual and definitional changes instituted by the 1975 National Income and Product Account revisions, 1975 data comparable to those used in the 1975 projections were not available. Bridging between published and desired figures was achieved through selected growth rates and judgmental changes.

[4] Paul M. Ryscavage, "BLS labor force projections: a review of methods and results," *Monthly Labor Review*, April 1979, pp. 15–22.

[5] The Thurow model used was that published in the June 1969 issue of the *Survey of Current Business*, "A Fiscal Policy Model of the United States," pp. 45–64.

[6] The bills-of-goods were distributed to 87 industries, but 5 of these were "special industries" in which no intermediate output was generated. Therefore, output was evaluated for only 82 industries.

[7] The conceptual and statistical changes of the 1976 national income revision forced the estimation of 1975 actual data for comparison. A major change was the use of a 1972-dollar base instead of a 1958-dollar base. Other examples of conceptual changes which occurred include the movement of landlord durables and mobile homes from personal consumption expenditures to investment, changes in the handling of net interest paid to foreigners, and changes to better estimate the value of leased computers. For consistency, it was necessary to "undo" these changes. For final demand, this required the estimation of actual 1975 bills-of-goods in 1958 dollars. For outputs, actual BLS production data were used, benchmarked to the 1967 data published in Bulletin 1733. The reader will note that no explicit analysis of the projected input-output matrix is done; resource constraints prevented calculation of an actual 1975 matrix. Despite these drawbacks, broad conclusions are possible. The data used here are considered an accurate representation of the 1975 economy and a fair yardstick for the projections which were made.

[8] When work began on this evaluation, it was discovered that the published inverse and final demands would not duplicate exactly the outputs found on worksheets. This was due to several factors, the most important of which seems to be the computer technology at the time. Creating an input-output table and inverse was a much more involved and time-consuming operation than it is today. Thus, last-minute changes appear to have been made to parts, but not carried through the entire process. Thus, the need was felt to rebalance the inverse so it would produce the desired outputs, given the published final demands. The changes made were very small. The new inverse was used in the evaluation.

[9] Several industries were combined before publication of the employment projections. Only 71 industries could be evaluated.

[10] Valerie A. Personick and Robert A. Sylvester, "Evaluation of BLS 1970 economic and employment projections," *Monthly Labor Review*, August 1976, pp. 13–26.

APPENDIX: An evaluation of Thurow model variables

The nature of the Thorow model as a fiscal policy model is derived from its exogenous variables. Most of these are structural assumptions, defining the level of the economy's capital stock, the characteristics of the population, and the level of prices among components of GNP. These variables are the product of analysts' judgment and expected trends. With them, the model is solved and the equation results are combined to produce an estimate of GNP demanded in a given year.

It is quite possible, and indeed expected, that the level of GNP demanded by consumers, businesses, government, and the foreign sector will differ from the level of GNP that can be supplied. That is, the level of demand may not be consistent with the employment level embodied in the supply GNP estimate. This employment level (and conversely, the unemployment level or rate) and several demand side exogenous variables controlled by the government sector constitute the remaining exogenous variables and are known as policy variables.

Policy variables are the major Thurow model assumptions and are used to balance the estimates of sup-

Table A-1. Error analysis of major endogenous variables of the Thurow model, 1970–75

[In percent]

GNP component	1970	1971	1972	1973	1974	1975	"U"¹	RMSE²
All components								
Average error	3.46	5.46	4.25	4.06	4.75	11.40	......	......
Average absolute error	8.08	10.85	12.03	12.35	11.15	16.30	......	......
By component								
Personal consumption expenditures	.11	.23	−.25	.84	.03	−.53	.87	1.7
Nonresidential structures	6.10	16.84	21.10	16.40	14.06	19.54	10.35	16.5
Producers durable equipment	−7.26	−7.90	−13.92	−17.94	−17.96	−13.17	7.97	13.7
Residential structures	−13.18	−1.21	−10.23	12.81	7.05	46.44	8.01	21.0
Imports	−20.70	−20.51	−23.46	−22.92	−25.01	−13.53	12.06	21.5
State and local government purchases	7.56	7.50	3.50	4.09	−2.10	−9.26	74.06	6.2

¹ Ratio of the error due to simulation to the error that would result if the initial simulation year's level (1970) continued to occur each year.

² Root mean square error.

ply and demand GNP. They include the unemployment rate, the level of Federal Government purchases, Federal transfer payments (social insurance payments), the corporate profits tax rate, Federal grants-in-aid to State and local governments, the interest rate on 3-to-5-year Treasury bonds, and a measure of the Federal tax on median family incomes. The unemployment rate generally is fixed at the outset and represents the analysts' assumptions about the capacity level at which the economy will operate over the projection period.

The remaining policy variables affect the income or revenue levels of the demand GNP components and thus can be used to shift components into equality with supply GNP. For example, an excess in demand GNP might be reduced by decreasing the level of personal consumption expenditures, as this category is generally the largest component of GNP. The projected assumption of government transfers to persons could be lowered, causing personal income to drop and consumption expenditures to consequently fall off. Alternatively, the rate at which the median family income is taxed might be increased.[1] The evaluation we wish to make is thus not of the errors in the level of GNP—for that level was merely passed through to the model from the supply calculations—but whether the model is indeed sensitive to the policy variable adjustments; and if so, whether their adjustment toward correct 1975 values brings the model close to the actual 1975 outcome.

The initial step in answering this question is to define a control, or base case—one from which the impacts of adjustments of policy variables can be measured. It is also necessary to identify weak or faulty equations in the model's use so as to be aware of them in interpreting results, and to suggest future refinements. For these purposes, the Thurow model was solved for each year during 1970–75, using actual values for each of the exogenous and policy variables. This period is equivalent to that used in the 1975 industry projections. Such a simulation is a stringent test of the Thurow model, because it originally was estimated on data for the years 1948–65; thus, in some cases, the equation coefficients may have been a contributing source of error.

Table A-1 lists the simulation results. The average error for all of the model's 40 endogenous variables was roughly 4.5 percent over the first 5 years and rose to 11.5 percent in 1975. The equations were not sensitive enough to pick up the fluctuations in 1970–71 and 1974–75, the two recent recession periods. That the errors in

Table A-2. GNP component effects of policy variable changes

[In percent]

GNP component	Grants-in-aid	Interest rate	Government transfers	Tax rate, corporate profits	Tax rate, median family income	Projected vs. actual percent error, component of GNP
Personal consumption expenditures	0.0	0.0	−0.34	0.0	0.0	11.3
Investment in nonresidential structures	0	0	0	0	0	50.3
Investment in producers durable equipment	0	0	0	10	50	29.8
Investment in residential structures	0	−12.0	−.50	0	0	90.[illegible]
Imports	0	0	−.20	0	0	22.9
State and local government purchases	2.2	0	0	0	0	12.7
Error, policy variable	−10.8	−40.4	−29.8	12.5	−10.3	

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variables tended to offset each other is indicated by the relatively larger average absolute errors.

Among endogenous GNP components, the equations leading to estimates of residential structures and imports seemed to be most in error. The investment in residential structures equation, while based on the 1968 housing goals assumptions, was more sensitive to long-term interest rates (as an availability of mortgage funds indicator) and disposable income—variables which changed little during the 1974–75 recession. The imports equation was dependent on income and a proxy for relative import prices. Both of these assumptions rose in value during the recession, overstating the import value. Further research into the specification of these two equations is warranted.

Personal consumption expenditures, as the largest component of demand GNP, was simulated within 1 percent of actual levels over the period. A closer look at the equations behind the income sector of the Thurow model leads to the conclusion that it is the most accurately specified. This point is important, because the policy variables used to balance the model are assumed to have their greatest impact on the income sector of the model.

The root mean square error (RMSE) measures the average absolute deviation of the simulated variable from its actual levels over 1970–75 and reinforces the above conclusions. The column of table A-1 labeled "U" contains a statistic which compares the error due to simulation with the error that would result if the initial simulation year's level (1970) continued to occur each year. For example, the error in simulated PCE is 1 percent as large as the error which would result if the 1970 PCE level ($477.5 billion) were used as an estimate of the 1975 PCE estimate ($551.9 billion). By this standard, all components were simulated by the model significantly better than by projection of a constant level.

Table A-2 shows the results of simulations run to evaluate the policy variables of the model. Each variable was changed by a standard of 10 percent toward the actual level; then, for each run, each endogenous component of demand GNP was compared to its base case level.

—— *FOOTNOTE* ——

[1] These policy adjustments assume that Federal Government expenditures are held constant. Changes in tax rates or transfer payments would directly affect government revenues and expenditures and would produce additional fiscal effects.

Evaluating the 1975 projections of occupational employment

BLS' industry-occupation matrix projections proved better than those of alternative methods, even though staffing patterns were error prone; new Federal-State employment data should improve projection accuracy

MAX L. CAREY

Accurate occupational projections are highly prized by educational policymakers and by those planning careers: a clear vision of the future is the best tool for making such important decisions. But the pitfalls of attempting to chart unknown events are legendary. An early 20th century forecaster of occupational growth, for example, concluded that nearly all U.S. women would eventually be employed by the telephone company, based on its growth rate and the occupational structure of its work force. Few occupational projections have been as inaccurate. Even fewer have been completely correct. The vast majority lie somewhere in between, and their value must depend on some measure of the degree of error.

This article examines differences between BLS' projected 1975 occupational employment and actual employment.[1] It does not address the standard to be used in judging whether a projection is "good." The degree of error that produces a decision different from that made with a perfectly accurate projection might separate "good" from "poor" projections. But because of the uncertainty of other variables in the decisionmaking process, estimates of such a turning point would be conjecture. Nevertheless, decisionmakers can benefit by an assessment of the accuracy of the projected numbers, including an analysis of the projection method to identify sources of error.

In 1967, the Division of Occupational Outlook completed a matrix that described the relationship of employment in 162 occupations and 124 industries during 1960 and projected these relationships to 1975.[2] The primary data sources for occupational employment were the 1950 and 1960 censuses and, for industry employment, annual estimates from the BLS establishment surveys beginning from 1947. A revision of the 1975 matrix was completed in 1969, based mostly on additional industry data. Although the revision was not published, it was used as a resource for the occupational outlook program, and provides an opportunity for evaluating projections with more historical data. Due to a major change in the occupational employment classification system beginning with the 1970 census, only 76 of the 162 detailed occupations were sufficiently comparable for evaluation.

Evaluation of projection methodology disclosed weakness in the estimation of industry-occupation employment ratios. The adequacy of decennial census data as a basis for projecting changes in industry-occupation patterns has always been regarded with some suspicion by BLS analysts, and concern about these data was a major factor in the decision to launch a cooperative Federal-State program in 1970 for surveying occupational employment. The current analysis has found that the census-based ratio estimates were a far greater source of error in the occupational projections than the estimates of industry employment levels. In fact, a simulated matrix based on actual 1975 industry employment levels and the estimated ratios produced

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occupational totals that were no more accurate, on average, than the projections, suggesting that the ratios were so poor that they would have even negated the effect of perfect industry projections.

The unforeseen economic downturn of the mid-1970's reduced the accuracy of the occupational projections, although the damage was not as great as initially supposed. The projections presumed an unemployment rate of 3 percent in 1975. But the target year turned out to be the trough of the recession, and the actual unemployment rate was 8.5 percent. Consequently, employment in occupations that are sensitive to economic cycles, such as craft and operative occupations, generally was overprojected. Employment in these two groups had been growing, and almost reached projected levels by 1974, but turned down as economic conditions worsened in 1975. Underprojections did occur in 3 of the 9 major occupational groups despite the recession, and these errors might have been somewhat higher if economic conditions in 1975 had been as favorable as assumed.

The difference between projected and actual employment for the major occupational groups ranged from a 6.7-percent underestimate of clerical workers to a 9.1-percent overestimate of operatives. The average of the absolute percentage differences was 6.1 percent. The projections for detailed occupations had a much larger error, averaging 20.8 percent off 1975 employment levels. Differences between projected and actual employment tended to increase as the size of the occupation diminished. The availability of more reliable historical data for larger occupations could be expected to improve projection accuracy. The greater accuracy of projections for the occupational groups, however, also reflects the compensating effect of aggregation, because most group totals were obtained by summing projections for detailed occupations. In addition to being weak for small occupations, the projections were relatively inaccurate for occupations that declined in employment or grew very rapidly.

Several projection methods that would have been simpler and less costly than the matrix were explored. Among these, the most successful was linear extrapolation of employment trends in each occupation. These extrapolations averaged an absolute 26.2 percent off actual 1975 employment in the 76 detailed occupations compared to the 20.8 percent error for the matrix projections.

Projection methods and assumptions

The basic approach used to estimate future occupational employment requirements was to project total employment by industry, project occupational staffing patterns (ratios) by industry, and then multiply the industry totals by the ratios to obtain occupational estimates. The results were then summed across industries to obtain occupational totals.[3]

Projections of the occupational structure of each industry were based on examination of historical statistics and the analysis of the factors that influence occupational structure changes, such as new technology and changes in the product mix of industry. Employment requirements for many occupations, however, were projected independent of their relationships to industry employment. The projection of school teachers, for example, was based on an analysis of trends in pupil-teacher ratios and the projected school-age population. This technique was preferred in cases where such reliable predictive relationships could be established.

The 1975 projections were premised on certain assumptions about the size of the labor force, Armed Forces strength, the rate of unemployment, and other selected assumptions. Full employment was assumed in the target year, and defined as a civilian labor force with a 3-percent unemployment rate. This figure was selected based on the almost steady decline in the unemployment rate through the 1960's and the emphasis placed on federally assisted programs to further reduce unemployment. A total labor force of 92.6 million was projected for 1975, and it was assumed that 2.7 million persons would be in the Armed Forces, yielding a civilian labor force of 89.9 million.[4] With the assumed unemployment rate, the result was projections of 87.2 million employed and 2.7 million unemployed workers in 1975. The 87.2 million employment number was used as a control total for the occupational projections.

The economic recession of the mid-1970's negated the assumption of a full-employment economy in the target year. The unemployment rate in 1975 was almost triple the assumed 3-percent rate. Reflecting the impact of the recession, the projection of total civilian employment was 2.9 percent higher than the actual level of 84.8 million in 1975, as shown in the following tabulation:

	Employment (thousands)		
Labor force groups	*Projected*	*Actual*	*Percent difference*
Total	92,600	94,793	−2.3
Armed Forces	2,700	2,180	23.9
Civilian labor force	89,900	92,613	−2.9
Employment	87,200	84,783	2.9
Unemployment	2,700	7,830	−65.6

The overstatement of 1975 employment would have been even greater if the civilian labor force had been more accurately projected. Primarily because the number of women entering the labor force was greater than anticipated, the total labor force exceeded the projected level by about 2 million.[5] In addition Armed Forces strength was about 1 million lower than assumed. The net result was a civilian labor force of 92.6 million instead of the projected 89.9 million. If the total labor force had been projected correctly, the unemployment assumption would have resulted in a 5.9-percent overstatement of target year civilian employment, rather than the 2.9-percent error that actually occurred.

The economic downturn of the mid-1970's caused distortions in occupational employment that were of greater magnitude than the relatively small difference between projected and actual total employment. Because individual unemployment rates for each occupation were not specified in the assumptions, the effect of the recession on the accuracy of a projection for any given occupation is difficult to measure. Unemployment data for major occupational groups, however, indicate that the economic downturn generally had a greater effect on blue-collar occupations than other categories.

Base and target years

Ambiguity regarding the base and target years or the projection span complicated the evaluation. Although 1960 was the published starting point, some data for more recent years were available before the projections were completed. And, although targeted for 1975, the projections were intended to be indicators of long-term trends rather than precise estimates for 1975.

The matrix was developed with a 1960 base and a 1975 target year; it did not have estimates for any intervening year. The only comprehensive source of data on industry-occupation employment patterns available at the time the matrix was being developed was the 1960 census, and this continued to be the most comprehensive source until results from the 1970 census became available. Published estimates of total wage and salary employment by industry from the establishment survey and total employment by occupational group from the Current Population Survey (CPS), however, were available annually through 1965 at the time the matrix was being prepared. In addition, unpublished CPS estimates of employment in detailed occupations were available.[8] Clearly, the post-1960 industry employment trends were used in projecting industry employment levels. The trends for occupational groups also were considered at least as guidelines, even though the projections for most groups were the sums of detailed occupational projections rather than being independently developed. The use of unpublished CPS data on detailed occupations was not well documented in the description of projection methodology, but the CPS trends for many detailed occupations reportedly were disregarded because of their uncertain reliability.

The fact that some post-1960 data were used tends to bias measures of projection accuracy that relate to the entire 1960–75 span because greater accuracy might be expected as the projection period was shortened. To avoid this problem, an evaluation must focus on differences between projected and actual employment *levels*, rather than differences between actual and projected employment *changes*. The difference in levels is the same regardless of the base year.

The lack of a satisfactory basis for fairly judging the projected changes in occupational employment is unfortunate. Comparisons of levels alone generally have a conservative bias: projections for occupations which have relatively little employment change tend to get better marks than those which have the most change, as demonstrated in the following example. If employment in occupation A was projected to rise from 100,000 to 200,000 over a decade, but actually rose to 150,000, then 50 percent of the change was projected, and the error in level is −25 percent. If employment in occupation B was projected to rise from 100,000 to 120,000 in the same period, but actually reached only 105,000, then 25 percent of the change was projected, but the error in the level is only −12.5 percent. In terms of the proportion of actual change that was projected, A is better, but in terms of the difference between levels, B is better. Both kinds of accuracy are important. The accuracy of level is particularly important in estimating future occupational requirements, however, because projected levels are used in calculating replacement needs due to retirements and deaths.

Another problem concerns the target year. The projections were intended to be indicators of secular or long-range trends rather than estimates of employment at a future point, because it is understood that such estimates easily can be upset by unforeseen cyclical activity. Thus, it might have been wiser to describe the projections as levels that might occur in the mid-1970's or in the 1974–76 period. The projections would have been more accurate statements, with little inconvenience to users.

As previously indicated, the recession of the mid-1970's was at its worst in 1975, and the effect on occupational employment levels was not uniform. Ideally, an evaluation would judge the projections by occupational employment levels that would have existed had the recession not occurred, but this was not a practical approach. As an alternative, the 1975 projections for the major occupational groups also were compared with actual employment in both 1974 and 1976, when economic conditions were somewhat better.

Occupational groups

The direction of employment change between 1960 and 1975 was correctly anticipated for all of the nine major occupational groups, although employment in five was overprojected. Projection errors ranged from an approximate 1.2-million overstatement of employment in the operative group to a 600,000 understatement of clerical employment. The average absolute error for all groups was 535,000. Relative differences ranged from a 10.2-percent overprojection of farmworkers in 1975 to a 7.4-percent underestimate of nonfarm laborers. The average of the absolute percentage errors for all groups was 6.1 percent.

The difference between projected and actual 1960–75 employment change in each occupational group varied considerably. The anticipated increase in the number of professional workers was only 5 percent greater than the actual growth. In contrast, the projected gain in laborer employment was 85 percent lower than the actual increase. On average, about two-thirds of the employment change that occurred in each occupational group between 1960 and 1975 was projected.[7]

Estimates for white-collar groups generally were closer to the mark than those for blue-collar groups—reflecting the distortions in occupational patterns resulting from the 1973–75 recession. Because such distortions probably were greater in 1975, when the recession was at its worst, projections also were compared with actual employment in adjoining years. (See table 1.) Estimates of the error for the nine occupational groups averaged an absolute 4.8 percent off 1974 levels and 6.0 percent off 1976 levels, compared to the 6.1-percent average absolute error for the target year.

Professional, technical, and kindred workers. As projected, this major occupational group led in comparative rates of growth. Employment reached 12.7 million in 1975, an increase of 77 percent from the 1960 level, compared with an anticipated 73-percent increase. Thus, the projected number of professional and technical workers was only 2.2 percent lower than the actual number in 1975, the smallest error among the occupational groups. The actual number, however, probably would have been slightly higher if economic conditions in 1975 had been favorable, as assumed.

Managerial workers. Employment grew more slowly than anticipated in this group, increasing 21 percent between 1960 and 1975, compared with projected 28-percent growth. The number of managerial workers was expected to be 5.3 percent higher than the reported 8.9 million in 1975. The projected 9.4 million, however, was almost attained in 1976 when employment reached 9.3 million.

Salesworkers. Employment in this group was overestimated by 2.6 percent, a smaller than average error. The number of salesworkers increased from 4.2 million in 1960 to nearly 5.5 million in 1975, almost reaching the projected 5.6 million.

Clerical workers. The projected number of clerical workers, the largest of the occupational groups, was 4 percent lower than the actual number in 1975. Employment reached 15.1 million in 1975, a gain of 58 percent over the 1960 level, compared with a projected 52-percent increase. The difference between projected and actual employment for this group probably would have been greater had the recession not occurred.

Craftworkers. The number of skilled blue-collar workers was overestimated by 6.4 percent. Employment was almost 11 million in 1975, about 25 percent higher than the 1960 level, instead of the anticipated 33-percent gain. The error was significantly affected by the recession. A large proportion of craft workers are employed in construction and manufacturing industries, which are more sensitive to economic fluctuations than most other industries. Craft employment, however, had risen to about 11.5 million in 1974, almost reaching the 11.7-million projected level before decreasing as the economy worsened in 1975.

Operatives. Employment in the largest blue-collar group was overestimated by 9.1 percent, the second highest error among the occupational groups. Instead of rising from 11.4 million in 1960 to 14 million in 1975 as projected, employment peaked at 13.9 million in 1974, then dropped to 12.9 million in 1975—again reflecting the impact of the recession. Operative employment was concentrated in manufacturing industries, where unemployment rates averaged more than 11 percent in 1975.

Laborers. The 3.8-million employment projection for this group was 7.4 percent too low; and because laborers are employed primarily in manufacturing and construction, the underestimate would have been even larger if economic conditions had been more favorable. The number of laborers increased more rapidly than anticipated, peaking at 4.4 million in 1974, before dropping to about 4.1 million in 1975.

Service workers. The projection for this fast growing occupational group was too high. Employment was expected to increase from 8.3 million to 12.5 million between 1960 and 1975, a gain of 50 percent. The actual gain was 40 percent. Service industry employment, which finally reached the 1975 projected level in 1978, would have been projected more accurately but for the recession.

Farmworkers. The employment of farmworkers was overstated by 10.2 percent, the highest error among the occupational groups. Although a decline in farmworkers was projected, the extent of decline was underestimated. A 38-percent decrease in the 5.2-million 1960 employment level was projected, but a 44-percent decrease occurred. The recession probably was not a significant factor in the projection error for farmworkers.

Specific occupations

The evaluation of employment projections for detailed occupations was limited by data constraints. The

Table 1. Comparison of 1975 occupational group employment projections and actual employment in 1974, 1975, and 1976
[Thousands of workers]

Occupational group	Employment					Percent difference between projected and actual			Percent change 1960-75	
	Actual 1960	Projected 1975	Actual 1974	Actual 1975	Actual 1976	1974	1975	1976	Projected	Actual
Total	65,777	87,200	85,935	84,783	87,485	1.5	2.9	-0.3	32.6	28.9
Professional and technical workers	7,208	12,462	12,338	12,748	13,329	1.0	-2.2	-6.5	72.9	76.9
Managers and administrators	7,337	9,361	8,941	8,891	9,315	4.7	5.3	.5	27.6	21.2
Salesworkers	4,210	5,600	5,417	5,460	5,497	3.4	2.6	1.9	33.0	29.7
Clerical workers	9,557	14,520	15,043	15,128	15,558	-3.5	-4.0	-6.7	51.9	58.3
Craft and kindred workers	8,751	11,674	11,477	10,972	11,278	1.7	6.4	3.5	33.4	25.4
Operatives	11,381	14,025	13,919	12,856	13,356	.8	9.1	5.0	23.2	13.0
Nonfarm laborers	3,778	3,830	4,380	4,134	4,325	-12.6	-7.4	-11.4	1.4	9.4
Service workers	8,346	12,483	11,373	11,657	12,005	9.8	7.2	4.1	49.7	39.7
Farmworkers	5,211	3,236	3,048	2,936	2,822	6.1	10.2	14.6	-37.9	-43.7

NOTE: Details may not add to totals because of rounding. Percent differences are based on unrounded numbers.

primary source of occupational employment data for the occupational matrix was the 1960 census, but the Census Bureau revised its system for classifying employment data by occupation for the 1970 census. Beginning in late 1971, the revised system was adopted for the Current Population Survey (CPS), the primary source of occupational employment data between decennial censuses. Primarily as a result of this classification change, projections for only 76 of the 162 occupations in the matrix were comparable with 1975 employment data estimated from the CPS. Comparability also was affected by survey differences. The CPS data have a larger sampling error than the 1960 census data that were used in developing the base year matrix. Sampling errors for small occupations represented sizeable proportions of the estimated actual employment. For example, the standard error for the smallest occupation with a CPS data source, asbestos and insulation workers, was about one-fifth of the 1975 estimated employment level of 29,500. The projection of 29,300 workers in this occupation could have been anywhere between about 23,400 and 35,200 without exceeding the sampling error (1 standard error of the estimate) for the estimate of actual employment. Although this example is extreme, it demonstrates the need for caution in comparing estimates of actual employment with projections. (For a more detailed explanation of this technical factor, see the appendix.)

Differences between projected and actual employment in the 76 detailed occupations ranged from −43 percent for personnel and labor relations workers to +136 percent for plasterers. (See table 2.) The absolute percentage errors for all 76 occupations averaged 20.8 percent. Two-thirds of the occupations, however, had errors lower than the average.

One way to judge projections is to compare them with the results obtained from simple alternative methods. The occupational projections were better descriptions of the future than extrapolations of trends in total employment for each occupation. Extensions of 1960-67 annual employment data by simple linear regression over time, which would have been an inexpensive and easy method of projecting, averaged an absolute 26.2 percent off 1975 actual levels compared with the 20.8-percent average absolute error for the projections. For about one-half of the occupations, however, the simple extrapolations of employment trends were more accurate than the projections.[8] Attempts to fit curves to the employment trends produced less accurate results than the linear extrapolations. Estimates also were developed with the projected civilian labor force used as the independent variable, but the results were relatively poor, being more accurate than the projections for less than two-fifths of the occupations.

Projection accuracy was related to the size of employment in an occupation. When weighted by employment in each occupation, the average absolute error drops from 20.8 percent to 14 percent, indicating that the largest occupations generally had the more accurate projections. Relatively accurate projections for the following four categories, each with more than 1 million workers in 1975, contributed substantially to the improved results: elementary school teachers; attendants, hospital and other institutions; waiters and waitresses; and stenographers, typists, and secretaries. The following tabulation shows how projection accuracy improved for occupations with more workers:

Number of workers in occupation	*Number of occupations*	*Average absolute percent error in projection*
Total	76	20.8
Less than 50,000	19	32.4
50,000 to 99,999	14	20.3
100,000 to 299,999	17	15.5
300,000 to 599,999	14	19.8
600,000 and more	12	11.2

Sampling errors for census estimates diminish relatively as employment size increases, so the historical data for large occupations would be expected to provide

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Table 2. Comparison of projected and actual 1975 employment in selected detailed occupations

[Thousands of workers]

Occupation	Employment			Difference between projected and actual		Percent change	
	Actual 1960	Projected 1975	Actual 1975	Level	Percent	Projected	Actual
Compositors and typesetters	182.5	155.0	154.0	1.0	0.6	-15.1	-15.6
Asbestos and insulation workers	19.6	29.3	29.5	-.2	-.7	49.5	50.5
Crane, derrick, and hoist operators	124.0	172.0	169.0	3.0	1.8	38.7	36.3
Nurses, professional	495.6	860.0	835.0	25.0	3.0	73.5	68.5
Waiters and waitresses	809.9	1,225.0	1,183.0	42.0	3.6	51.4	46.2
Pharmacists	112.9	125.0	119.1	5.9	4.9	10.7	5.5
Bartenders	163.7	233.0	247.0	-14.0	-5.7	42.3	50.9
Clergy	200.0	240.0	255.3	-15.3	-6.0	20.0	27.7
Dietitians and nutritionists	27.1	36.6	39.2	-2.6	-6.6	35.1	44.6
Optometrists	17.0	20.0	18.7	1.3	7.0	17.6	10.0
Elementary school teachers	977.9	1,233.0	1,332.0	-99.0	-7.4	26.1	36.2
Meat cutters and butchers, except meat packing	189.9	222.7	207.0	15.7	7.6	17.3	9.0
Attendants, hospitals and other institutions	450.0	1,083.0	1,001.0	82.0	8.2	140.7	122.4
Airplane pilots and navigators	28.5	55.0	60.0	-5.0	-8.3	93.0	110.5
Veterinarians	18.6	26.0	24.0	2.0	8.3	39.8	29.0
Cabinetmakers	66.0	75.0	81.9	-6.9	-8.4	13.6	24.1
Cement and concrete finishers	46.0	75.0	82.0	-7.0	-8.5	63.0	78.3
Carpenters	832.0	900.0	988.0	-88.0	-8.9	8.2	18.8
Furnace tenders, smelters, and pourers	52.1	56.4	62.0	-5.6	-9.0	8.3	19.0
Machinists and related occupations	495.1	504.0	461.0	43.0	9.3	1.8	-6.9
Police and detectives	287.0	518.0	473.0	45.0	9.5	80.5	64.8
Molders, metal	54.2	56.0	51.0	5.0	9.8	3.3	-5.9
Plumbers and pipefitters	303.0	425.0	386.0	39.0	10.1	40.3	27.4
Electrical engineers	174.7	319.8	290.0	29.8	10.3	83.1	66.0
Stenographers, typists, and secretaries	2,383.0	3,900.0	4,370.0	-470.0	-10.8	63.7	83.4
Millwrights	69.0	87.8	79.0	8.8	11.1	27.2	14.5
Postmasters and assistants	39.2	34.2	30.5	3.7	12.1	-12.8	-22.2
Welders and flame cutters	355.0	575.0	654.0	-79.0	-12.1	62.0	84.2
Mail carriers, post office	205.5	290.0	258.5	31.5	12.2	41.1	25.8
Jewelers and watchmakers	37.0	39.0	44.7	-5.7	-12.8	5.4	20.8
Railroad conductors	43.3	44.4	39.3	5.1	13.0	2.5	-9.2
Firefighters	148.9	250.0	221.0	29.0	13.1	67.9	48.4
Radio and television repairers	103.3	140.4	124.0	16.4	13.2	35.9	20.0
Delivery and route drivers, taxicab drivers, and chauffeurs	597.5	845.0	744.0	101.0	13.6	41.4	24.5
Food counter and fountain workers	150.4	320.0	372.0	52.0	-14.0	112.8	147.3
Cooks, except private household	530.0	860.0	1,001.0	-141.0	-14.1	62.3	88.9
Roofers and slaters	50.0	68.5	80.0	-11.5	-14.4	37.0	60.0
Shipping and receiving clerks	325.0	365.0	428.0	-63.0	-14.7	12.3	31.7
Airplane mechanics	111.6	138.7	120.0	18.7	15.6	24.3	7.5
Electricians	359.0	450.0	534.0	-84.0	-15.7	25.3	48.7
Guards	330.0	415.0	492.0	77.0	15.7	25.8	49.1
Sailors and deckhands	32.3	27.1	32.5	5.4	16.6	-16.1	.6
Railroad brake and switch operators	103.2	110.7	94.8	15.9	16.8	7.3	-8.1
Dentists	86.7	124.7	106.7	18.0	16.9	43.8	23.1
Accountants and auditors	429.3	660.0	797.8	-137.8	-17.3	53.7	85.8
Cashiers	478.3	973.0	1,180.0	-207.0	-17.5	103.4	146.7
Blue-collar workers, supervisors	1,137.0	1,650.0	1,393.0	257.0	18.4	45.1	22.5
Lawyers and judges	225.0	320.0	392.0	-72.0	-18.4	42.2	74.2
Chemical engineers	39.8	61.7	52.0	9.7	18.7	55.0	31.3
Physicians, medical and osteopathic	234.0	390.1	328.1	62.0	18.9	66.7	40.2
Drafters	233.0	375.0	311.9	63.1	20.2	60.9	33.9
Editors and reporters	100.0	128.0	160.8	-32.8	-20.4	28.0	60.8
Postal clerks	242.7	340.0	281.5	58.5	20.8	40.0	16.0
Bank tellers	127.0	263.0	350.0	-87.0	-24.9	107.1	175.6
Boilermakers	24.1	27.4	36.9	-9.5	-25.7	13.7	53.1
Heat treaters, and annealers	20.4	21.5	17.0	4.5	26.5	5.4	-16.7
Mechanical engineers	153.5	254.6	200.0	54.6	27.3	65.9	30.3
Locomotive engineers	46.5	50.0	38.9	11.1	28.5	7.5	-16.3
Surveyors	44.0	82.0	63.0	19.0	30.2	86.4	43.2
Weavers, textile	61.0	40.5	31.0	9.5	30.6	-33.6	-49.2
Telephone operators	355.2	452.0	344.0	108.0	31.4	27.3	-3.2
Photographers	51.0	57.0	83.3	-26.3	-31.6	11.8	63.3
Printing press operators	75.4	99.7	146.0	-46.3	-31.7	32.2	93.6
Social and welfare workers	105.0	218.0	320.6	-102.6	-32.0	107.6	205.3
Aeronautical engineers	45.8	68.6	51.6	17.0	32.9	49.8	12.7
Inspectors, log and lumber	19.5	24.7	18.5	6.2	33.5	26.7	-5.1
Psychologists	17.0	40.0	61.0	-21.0	-34.4	135.3	258.8
Power station operators	20.9	24.2	17.7	6.5	36.7	15.8	-15.3
Locomotive engineers' helpers	41.6	6.6	10.5	-3.9	-37.1	-84.1	-74.8
Personnel and labor relations workers	100.0	191.0	333.1	-142.1	-42.7	91.0	233.1
Photoengravers and lithographers	24.2	55.0	37.5	17.5	46.7	127.3	55.0
Civil engineers	146.0	248.2	160.0	88.2	55.1	70.0	9.6
Credit managers	50.1	89.1	57.0	32.1	56.3	77.8	13.8
Patternmakers, metal and wood	40.4	49.0	30.0	19.0	63.3	21.3	-25.7
Fallers, buckers, and toppers	44.0	43.5	25.0	18.5	74.0	-1.1	-43.2
Plasterers	50.0	61.0	25.8	35.2	136.4	22.0	-48.4

NOTE: Employment levels are expressed in rounded numbers, but percentage differences are based on unrounded numbers.

were obtained by summing projections for detailed occupations. Within a group, overestimates for some detailed occupations tended to be offset by underestimates for others.

The direction of employment change between 1960 and 1975 was correctly anticipated for 64 of the 76 detailed occupations. Again, results were best in the larger fields of employment. The occupations for which the direction of change was identified had average employment of about 245,000 in 1960; those with projections in the wrong direction had an average of less than 107,000 employees. Moreover, only 4 of the 51 occupations with more than 50,000 workers in 1960 had projections that were in the wrong direction, while 8 of the 25 smaller fields had that mistake. Some of the differences, however, between projected increases and actual declines, or vice versa, were relatively small.

The poor performance in estimating future employment requirements for small occupations raises questions about whether BLS should be attempting to develop projections for occupations that lack reliable employment data because of sampling error or other problems. In an effort to provide users with estimates for a larger number of fields, possibly more harm than good is being done.

Employment grew in 60 of the detailed occupations between 1960 and 1975, and declined in the remaining 16. Increases were estimated more accurately than decreases. Projections for growing occupations averaged an absolute 17 percent off actual employment, while those for occupations with losses averaged 35 percent off. Projections of growth were closely divided between underestimates and overestimates of reported employment gains. Almost all employment declines were underestimated.

The direction of employment change was correctly anticipated for all but one of the growing occupations. The number of sailors and deckhands increased by about 1 percent instead of declining by 16 percent as projected. The standard error for the estimate of 1975 employment in this occupation was much greater than 1 percent, however, so a decrease actually may have occurred. In fact, a decrease seems likely because total employment in the water transportation industry decreased in the 1960's and early 1970's.

Occupations at either end of the employment growth spectrum generally had less accurate projections than those in the middle. As the following tabulation shows, occupations with the most rapid growth had the largest projection errors, and the slowest growth occupations had somewhat larger errors than those with moderate growth.

employment, 1960-75	*occupations*	*in projection*
Average of all growth rates, 58.1 percent	60	17.0
Less than 20	12	20.5
20 to 39	16	13.1
40 to 59	11	16.6
60 to 89	12	14.2
90 or more	9	23.7

Target year employment usually was underestimated in the fastest growing occupations and overestimated in those with the slowest growth. Projections were lower than actual levels in 14 of the 15 fastest growing occupations, and higher than actual in 12 of the 15 with the slowest increases.

Decreases were not anticipated in 11 of the 16 occupations that declined in employment. Projections for four of these occupations were within the range of sampling error (1.6 standard errors of the estimate) for estimates of actual 1975 employment, but this limit was exceeded for plasterers, patternmakers, telephone operators, power station operators, machinists, and railroad engineers and brake and switch operators. The projections correctly identified postmaster, weaver, knitter, and locomotive engineer's helper as occupations which would decline in employment, although the rate of decrease was underestimated for three of these four.

Revised projections

A revision of the 1960-75 matrix improved the accuracy of the occupational projections somewhat. The revision was based on 2 years of additional information which had become available after the initial matrix was completed. The basic economic assumptions, such as the size of the labor force and the unemployment rate, remained the same, but projections of industry employment levels were revised in line with more recent data.[9] The industry-occupation ratios, however, continued to be based primarily on the 1950 and 1960 censuses. For about two-thirds of the industries, the revised employment projections were either as accurate or more accurate than the initial projections.[10] The effect of the revision on the accuracy of ratios could not be determined because industry-occupation employment patterns for 1975 have never been developed.

The average absolute 6.1-percent error for the nine occupational groups in the initial projection was reduced to 3.7 percent with the revision. The most significant improvement was a reduction in the overstatement of farmworkers from 10.2 percent to less than 1 percent. Errors in estimates for professional, managerial, and laborer groups also were reduced. The revised projections, however, were less accurate for the sales, craft, and operative groups.

The revision improved the accuracy of projections for half of the 76 detailed occupations included in the evaluation, and reduced the accuracy for the remaining half. The degree of error was lowered. The 76 occupational projections in the original matrix averaged an absolute 20.8 percent off actual 1975 employment levels; the revision reduced this to 19.4 percent, and several of the worst estimates were improved. The largest error, a 136-percent overestimate of the number of plasterers employed in 1975, was reduced to 53 percent. Large projection errors for civil engineers and for photoengravers and lithographers also were reduced substantially. Occupations with significantly less accurate projections as a result of the revision included weavers, machinists, airplane pilots and navigators, and airplane mechanics. Most of the changes reflected adjustments both in industry employment levels and staffing patterns. Changes in the airplane pilot and mechanic projections, however, were primarily a result of a revision in the air transportation industry projection, while the change in the plasterer estimate was almost entirely a result of an adjustment to the construction industry's occupational profile.

Considerable differences appeared when the original and revised projections were ranked according to accuracy. Only two occupations were among the 10 with the most accurate projection in each version. Even among each top 20, there were only 10 occupations in common. However, 14 occupations were common to the bottom 20 for each version. Because errors for the best projections fell within a much more narrow range than those for the worst projections, the order at the top of the scale was more sensitive to the revision.

Although several major changes were made and rankings were upset, the new estimates for most occupations were fairly close to the original projections. The revised figures averaged an absolute 11.4-percent change from the initial estimates, and the differences for almost three-fourths of the detailed occupations were smaller than the average. In addition, similar patterns were observed in both sets of projections. The largest occupations usually had the most accurate projections, and employment increases were estimated much more accurately than declines. In both the original and revised estimates, errors for occupations that declined in employment averaged about twice as high as those for occupations with employment growth. Both declines and rapid increases in employment generally were underestimated.

The relatively small difference between the initial and revised projections suggest that it may not be worthwhile to revise matrices unless additional years of data on both industry employment and industry-occupation ratios are available.

Matrix errors

A major objective of this evaluation was to isolate the effects of errors in the matrix elements that determine occupational employment in the target year—projected employment by industry, and projected occupational staffing patterns for each industry (industry-occupation ratios). Ideally, the error caused by each of these factors would be determined by developing simulated matrices that combine actual data for one factor with projected data for another. Unfortunately, because actual ratios for 1975 were not available, the effect of projected industry employment totals could not be isolated, and therefore an analysis of both factors and their interaction was not possible. However, a simulated matrix based on actual industry employment totals and projected ratios was developed, and the resultant set of occupational projections was compared to actual occupational totals to determine the effect of the projected ratios alone.

The revised matrix was used for the simulation because the computer system that processed the initial version was incompatible with later systems. Resources did not permit development of 1975 industry totals for this exercise. As an alternative, data for the simulation were obtained from a set of 1974 industry employment totals which had previously been developed as a base for the 1985 matrix projections. However, the use of actual data from 1974, rather than from 1975, should give a more valid measure of ratio errors because recession-induced distortions in industry occupational relationships were probably less pronounced in 1974.

Contrary to what might be expected, the simulated projections turned out to be less accurate than the projections. Revised 1975 projections for the detailed occupations averaged an absolute 16.2 percent off actual 1974 employment levels. When actual industry employment levels were substituted for projected levels in the matrix, and the ratios remained as projected, the average absolute error for the occupational projections increased slightly to 16.3 percent. This comparison indicates that the ratios, rather than industry levels, were the primary source of error in the projected occupational totals. That is, because perfect industry employment projections would not have improved the accuracy of the occupational projections, the fault must have been mostly with the ratios.

The problem with projected ratios was more pervasive than the small difference in the two average errors might suggest. The simulations were worse than the projections for 49 of the 76 occupations in the study, but resulted in substantial improvements for many of the remaining 27, thus bringing the average error for the simulations more in line with that of the projections. (See table 3.) Among the estimates benefiting

[Thousands of workers]

Occupation	Employment			Difference between projected and actual		Difference between simulated and actual	
	Projected 1975¹	Simulated 1975	Actual 1974	Level	Percent	Level	Percent
Food counter and fountain workers	349.1	363.2	351.0	-1.9	-0.5	12.2	3.5
Police and detectives	504.7	452.1	514.0	-9.3	-1.8	-61.9	-12.0
Asbestos and insulation workers	30.4	29.5	30.0	.4	1.3	-.5	-1.7
Elementary school teachers	1,317.6	1,211.3	1,299.8	17.8	1.4	-88.5	-6.8
Electrical engineers	281.8	262.9	287.0	-5.2	-1.8	-24.1	-8.4
Molders, metal	60.0	60.2	58.9	1.1	1.9	1.3	2.2
Railroad conductors	40.9	41.7	40.0	.9	2.3	1.7	4.3
Dietitians and nutritionists	33.8	34.7	33.0	.8	2.4	1.7	5.2
Compositors and typesetters¹	170.7	160.7	166.0	4.7	2.8	-5.3	-3.2
Optometrists	18.9	21.5	18.3	.6	3.3	3.2	17.5
Firefighters	226.8	199.3	219.0	7.8	3.6	-19.7	-9.0
Meat cutters and butchers, except meat packing	194.6	205.8	202.0	-7.4	-3.7	3.8	1.9
Waiters and waitresses	1,137.4	1,269.5	1,181.9	-44.5	-3.8	87.6	7.4
Nurses, professional	825.7	872.5	790.0	35.7	4.5	82.5	10.4
Welders and flame cutters	612.9	598.9	646.0	-33.1	-5.1	-47.1	-7.3
Locomotive engineers	44.3	45.3	42.0	2.3	5.5	3.3	7.9
Plumbers and pipefitters¹	424.5	415.2	402.3	22.2	5.5	12.9	3.2
Electricians	524.0	510.9	558.3	-34.3	-6.1	-47.4	-8.5
Heat treaters, annealers¹	23.7	22.8	22.3	1.4	6.3	.5	2.2
Radio and television repairers	143.3	155.6	134.0	9.3	6.9	21.6	16.1
Millwrights	88.2	85.5	95.0	-6.8	-7.2	-9.5	-10.0
Stenographers, typists, and secretaries	4,015.8	3,940.1	4,330.0	-314.2	-7.3	-389.9	-9.0
Sailors and deckhands	30.5	28.7	33.0	-2.5	-7.6	-4.3	-13.0
Physicians, medical and osteopathic	340.3	378.3	315.0	25.3	8.0	63.3	20.1
Railroad brake and switch operators¹	79.2	81.1	87.0	-7.8	-9.0	-5.9	-6.8
Carpenters	991.8	969.4	1,084.2	-92.4	-8.5	-114.8	-10.6
Mail carriers, post office¹	290.6	250.8	267.0	23.6	8.8	-16.2	-6.1
Delivery and route drivers, taxicab drivers, and chauffeurs	696.4	659.8	766.9	-70.5	-9.2	-107.1	-14.0
Cement and concrete finishers	80.9	79.1	90.0	-9.1	-10.1	-10.9	-12.1
Clergy	218.2	190.9	245.0	-26.8	-10.9	-54.1	-22.1
Blue-collar workers, supervisors¹	1,615.8	1,576.6	1,457.1	158.7	10.9	119.5	8.2
Photographers	71.3	63.9	80.0	-8.7	-10.9	-16.1	-20.1
Cabinetmakers¹	73.4	75.1	82.5	-9.1	-11.0	-7.4	-9.0
Chemical engineers¹	55.6	53.4	50.0	5.6	11.2	3.4	6.8
Dentists	111.2	125.7	100.0	11.2	11.2	25.7	25.7
Crane, derrick, and hoist operators	163.8	161.4	184.7	-20.9	-11.3	-23.3	-12.6
Lawyers and judges¹	316.3	320.2	359.9	-43.6	-12.1	-39.7	-11.0
Cooks, except private household	834.8	892.5	954.9	-120.1	-12.6	-62.4	-6.5
Shipping and receiving clerks	406.3	400.4	465.0	-58.7	-12.6	-64.6	-13.9
Cashiers¹	970.0	1,023.5	1,110.9	-140.9	-12.7	-87.4	-7.9
Airplane pilots and navigators¹	78.0	71.9	69.0	9.0	13.0	2.9	4.2
Surveyors	63.3	59.7	73.0	-9.7	-13.3	-13.3	-18.2
Pharmacists¹	137.5	134.7	120.0	17.5	14.6	14.7	12.3
Guards	402.2	375.9	473.0	-70.8	-15.0	-97.1	-20.5
Inspectors, log and lumber	21.6	22.4	18.7	2.9	15.5	3.7	19.8
Photoengravers and lithographers¹	41.7	38.9	36.0	5.7	15.8	2.9	8.1
Postmasters and assistants	35.9	31.0	31.0	4.9	15.8	0	0
Telephone operators¹	454.1	449.0	390.0	64.1	16.4	59.0	15.1
Psychologists	44.0	42.4	53.0	-9.0	-17.0	-10.6	-20.0
Postal clerks¹	346.7	299.3	293.0	53.7	18.3	6.3	2.2
Bank tellers	270.4	293.5	335.9	-65.5	-19.5	-42.4	-12.6
Furnace tenders, smelters, and pourers	62.6	61.6	78.8	-16.2	-20.6	-17.2	-21.8
Roofers and slaters	71.3	70.2	90.0	-18.7	-20.8	-19.8	-22.0
Veterinarians	29.0	30.4	24.0	5.0	20.8	6.4	26.7
Accountants and auditors¹	630.8	674.8	810.0	-179.2	-22.1	-135.2	-16.7
Attendants, hospital and other institutions	1,125.7	1,184.1	915.6	210.1	22.9	268.5	29.3
Bartenders¹	179.2	203.7	233.0	-53.8	-23.1	-29.3	-12.6
Editors and reporters	118.9	112.4	156.0	-37.1	-23.8	-43.6	-27.9
Credit managers	82.0	86.1	66.0	16.0	24.2	20.1	30.5
Patternmakers, metal and wood¹	50.6	47.1	40.7	9.9	24.3	6.4	15.7
Jewelers and watchmakers¹	34.1	36.5	45.3	-11.2	-24.7	-8.8	-19.4
Drafters¹	386.2	382.5	298.0	88.2	29.6	84.5	28.4
Civil engineers¹	217.5	206.8	167.0	50.5	30.2	39.8	23.8
Airplane mechanics¹	166.8	144.4	128.0	38.8	30.3	16.4	12.8
Social and welfare workers	210.5	194.2	305.3	-94.8	-31.1	-111.1	-36.4
Weavers, textile	55.4	58.3	41.6	13.8	33.2	16.7	40.1
Mechanical engineers¹	247.2	231.1	183.0	64.2	35.1	48.1	26.3
Personnel and labor relations workers	211.7	205.4	325.0	-113.3	-34.9	-119.6	-36.8
Power station operators	24.1	24.5	17.8	6.3	35.4	6.7	37.6
Boilermakers	25.6	24.8	40.0	-14.4	-36.0	-15.2	-38.0
Printing press operators	89.9	84.2	142.0	-52.1	-36.7	-57.8	-40.7
Knitters, loopers, and toppers	47.2	49.8	33.5	13.7	40.9	16.3	48.7
Machinists and related occupations¹	636.2	607.1	450.4	185.8	41.3	156.7	34.8
Locomotive engineers' helpers	15.9	16.2	11.0	4.9	44.5	5.2	47.3
Aeronautical engineers¹	74.2	57.1	51.2	23.0	44.9	5.9	11.5
Plasterers	38.5	38.7	26.6	12.0	46.5	12.1	45.5

¹ The accuracy of the occupational projection was reduced as a result of reinforcing errors in the projections of industry-occupation ratios and industry employment levels.

NOTE: Projections of 1975 employment used here are based on the 1960 revision. Employment levels are expressed in rounded numbers, but percentage differences are based on unrounded numbers.

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most from the actual industry employment data were those for airplane pilots and navigators, aerospace engineers, and postal clerks, reflecting the fact that the industries where these fields are concentrated—air transportation, aircraft manufacturing, and post office—had some of the least accurate projections of industry employment levels.

When weighted by employment, the average absolute error for the simulated projections dropped from 16.3 percent to 12.6 percent, an indication that the ratio estimates were better for the larger fields of employment. The error for occupations with fewer than 50,000 employees in 1974 was almost twice that of those with a half million or more workers. Weak ratio estimates for small fields of employment may be related to problems with historical data on industry-occupation patterns. Survey errors were relatively large for census estimates of total employment in small occupations, and the problem may be compounded when these totals are disaggregated among the industries. A large number of occupations are so widely dispersed that only a fraction of 1 percent is found in many industries.

The failure to anticipate the impact of technological change and other factors that affect occupational needs also contributed to ratio errors. In estimating ratios for knitters, for example, it was assumed that increases in the demand for knit goods would more than offset the employment effect of laborsaving technology. Although total employment in the knitting industry grew even more than projected, employment in this occupation declined as a result of larger capacity, higher speed machinery and other technological developments. Misassessments of the effect of technological developments also contributed to overprojected demand for plasterers, weavers, telephone operators, and several railroad occupations. In most cases, the laborsaving technology had been identified, but its future impact was difficult to project because data were either insufficient or nonexistent.

Compensating errors in the estimates of industry employment levels and ratios improved the accuracy of projections for 49 of the 76 occupations.[11] For example, total employment in the health services industry (excluding hospitals), where almost all optometrists were expected to be employed, was underprojected by about 12 percent, yet employment in this occupation was overprojected by about 4 percent. From this evidence, it can be concluded that an overstated ratio for optometrists almost offset the effect of an industry projection that was too low. The most accurate projections generally were products of this kind of counterbalancing. Compensating errors however, were not entirely the result of chance. In some cases, occupational projections that were developed independently conflicted with industry employment projections and, in adjusting these projections for consistency, ratios sometimes were distorted.

Errors caused by the two factors were reinforced for about one-third of the occupations, many of which had the least accurate projections. Occupations with reinforcing errors are identified by footnote in table 3; those not noted have compensating errors, with the exception of postmasters, which had no error at all because the ratio projection for this occupation was perfect.

New projections

Although the occupational projections were off the mark for many reasons, including the economic downturn in 1975, the evaluation has established that the ratio estimates were the largest source of error. These estimates were based on scanty data for trends in the occupational structure of industries. Although the projections were made in the late 1960's, the only comprehensive sources of historical data on ratios were the 1950 and 1960 decennial censuses. A long recognized need for current, detailed data on industry staffing patterns prompted the initiation of the cooperative Federal-State program, Occupational Employment Statistics (OES), in 1970. Data on employment by industry is now collected in 3-year cycles for more than 2,000 occupations through the OES survey. Through March 1979, 46 States and the District of Columbia were cooperating in the program, and BLS plans to complete the development of an OES-based 1980–90 national matrix in 1981.[12]

The recession in 1975 adversely affected the projections for many of the blue-collar occupations concentrated in construction and manufacturing industries. Alternative projections could address the problem of cyclical fluctuations. Rather than preparing projections based on one set of assumptions about the economy in the target year, alternative projections could be developed with different assumptions about the unemployment rate, the GNP, and other variables. BLS took a step in that direction in 1976 by developing 1985 industry-occupation matrices based on different sets of assumptions or scenarios about the economic policies that the Federal government might follow to sustain a recovery from the 1973–75 recession.[13] To assess the extent that occupational employment might be affected, industry employment projections based on each scenario were translated into occupational projections by applying them to fixed matrix ratios. Occupational projections based on two versions of what the economy might look like in 1990 are in preparation. As a refinement to the method used for 1985 estimates, matrix ratio patterns will be projected for each version of the 1990 economy rather than using the same pattern for both. One of the limitations of the scenario approach, howevcan isolate the effects of specific alternative assumptions.

Continuing analysis of the accuracy of projections is an important activity in improving their reliability. come a regular part of the occupational outlook program. Actual employment data soon will be available for comparison with the 1980 occupational projections. □

FOOTNOTES

[1] Evaluations of earlier occupational projections are described in Sol Swerdloff, "How good were manpower projections for the 1960's," *Monthly Labor Review*, November 1969, pp. 17–22.

[2] The Bureau's occupational projections for 1975 were first published in *Occupational Employment Patterns for 1960 and 1975*, Bulletin 1599, Bureau of Labor Statistics, December 1968. The projections also were presented in a corollary report, *Tomorrow's Manpower Needs*, Volume IV, Bulletin 1606, Bureau of Labor Statistics, February 1969. The projections evaluated in this article were obtained from the latter publication. There are minor differences in estimates presented in the two publications.

[3] For a detailed discussion of the methodology used in developing industry-employment projections, see *Tomorrow's Manpower Needs*, pp. 5–8. The industry employment projections represented the collaborative efforts of several research staffs in the Bureau, including those working on technological change and productivity, economic growth, and occupational outlook. The general structure of employment by industry, however, was developed through an economic growth model which used an input-output approach.

[4] See Sophia (Cooper) Travis and Denis F. Johnston, "Labor force projections for 1970–80," *Monthly Labor Review*, February 1965, pp. 129–40.

[5] Evaluations of labor force projections for 1975 are described in Paul M. Ryscavage, "BLS labor force projections: a review of methods and results," *Monthly Labor Review*, April 1979, pp. 15–22.

[6] In more recent times, the CPS data and industry employment estimates were used to construct base matrices for years between decennial censuses. For example, the Bureau developed a 1974 base year matrix for its 1985 occupational projections, then a 1976 base for a revision of these projections. The detailed occupational totals in these matrices are a refinement of the CPS estimates.

[7] If 1965 is regarded as the starting point for the projections, the performance is not as good. The percentage of employment projected for the occupational groups averages about 52 percent if the change is measured from 1965 to 1975, compared to about 68 percent if change is measured from 1960 to 1975. The better performance when the span is greater is in part due to the projections being credited for some of the employment changes that already had occurred. As pointed out in the explanation of the problem with identifying the base year, data on occupational group employment were already available through 1965 at the time the projections were being prepared, and measures of accuracy that center on the amount of change projected will reflect this bias. The recession also was a factor, however, in that some of the employment gains that took place after 1965 were erased by the economic downturn in the mid-1970's. Employment in the operative group in fact was lower in 1975 than in 1965, although it had grown through the late 1960's and early 1970's. If this occupation is excluded from the average, the difference for the two time spans is reduced substantially. Excluding operatives, the projections accounted for an average of about 73 percent of the employment change in occupational groups during the 1960–75 period, and an average of about 71 percent of the change during the 1965–75 period.

[8] Extrapolations were based on 1960 Census data and 1962–67 CPS data (1961 data were not available). Comparable CPS employment series were not available for 4 of the 76 occupations in the study. Thus, extrapolations were developed for only 72 occupations. Extrapolation for 3 occupations resulted in negative employment in 1975; these negative numbers were arbitrarily adjusted to positive employment levels of 100 workers. Although the matrix projections used data only through 1965, data were available through 1967 by the time the matrix was submitted for publication. Because of the amount of time required to prepared the matrix, it was difficult to incorporate changes that reflected the latest data. Simple extrapolations, on the other hand, can be prepared in a very short time, making it easier to take advantage of the latest data.

[9] BLS later developed three alternative sets of industry employment projections for 1975 as a part of a contract with the U.S. Arms Control and Disarmament Agency to study the economic impact of a withdrawal from Vietnam. For a description of these projections, see *Projections of the Post-Vietnam Economy*, Bulletin 1733, Bureau of Labor Statistics, 1972. For an evaluation of the basic alternative set of industry employment projections, see Paul T. Christy and Karen J. Horowitz, "An Evaluation of BLS Projections of 1975 Production and Employment," *Monthly Labor Review*, August 1979, pp. 8–10.

[10] The measure of improvement in the accuracy of industry employment projections was based on estimates of total employment obtained from a 1974 base year matrix because a 1975 base year matrix was not available.

[11] The presence of compensating errors for an occupation was difficult to determine with certainty because the lack of data on actual ratios for the target year prevented isolating the effect of errors in industry projections alone. As a rule, however, errors in the industry and ratio projections are compensating for an occupation if (1) the sign of the projection error (table 5, fourth column) is different than the sign of the result of subtracting the simulation error (table 5, seventh column) from the projection error, or (2) the signs of the projection and simulation errors in these two columns are the same, but the projection error has a lower absolute level.

[12] For a description of the OES program, see *Occupational Employment Statistics Handbook*, Bureau of Labor Statistics, April 1979.

[13] See Max L. Carey, "Revised occupational projections to 1985," *Monthly Labor Review*, November 1976, pp. 10–21.

APPENDIX: Technical factors

Resource constraints precluded construction of a 1975 matrix for the purpose of evaluating the occupational employment projections. Consequently, 1975 employment levels had to be estimated from (1) base year matrices for 1974 and 1976, which had already been developed by the Bureau in preparing and revising 1985 projections, and (2) from Current Population Survey (CPS) data, the primary source of occupational data for matrices between decennial censuses. The evaluation also was handicapped by a loss in the continuity of comparable employment data as a consequence of a revision in the occupational classification system used by the Census Bureau. In addition, relatively large sampling errors for CPS estimates of actual 1975 employment were a problem for some occupations.

Much of the occupational data from the 1960 Census, which was the principal data base for the projected 1975 matrix, is not comparable with CPS data collected after 1971. The 1960 Census system for classifying employment by occupation and industry was revised for the 1970 Census, and beginning in late 1971, the revised system was adopted for the CPS. Interrelationships between the two systems were quantified in the Census publication, *Technical Paper 26, 1970 Occupation and Industry Classification Systems in Terms of Their 1960 Occupation and Industry Elements.* According to the information in this report, all nine occupational groups had 96 percent or better comparability between the two classification systems. Specifically, if the 1960 labor force data were retabulated, 95 percent or more of the labor force reported in a particular occupational group under the 1960 classification system would remain in the same group under the 1970 system, and these workers would represent 95 percent or more of the total for that group. At a more detailed occupational level, the comparability gap was wider. Of the 297 occupations in the 1960 classification system, 171 had 90 percent or better comparability in the 1970 system. About one-half of these occupations, however, were not included in the matrix. In addition, the accuracy of some of the projections that were based on historical data from sources other than the census could not be verified. After eliminating occupations which were less than 90 percent comparable and those which had verification problems, the evaluation of projections was limited to 76 of the 162 detailed occupations covered in the matrix.

Estimates from the CPS were subject to greater sampling variability than those from the decennial census. For an occupational estimate of 50,000, for example, the standard error would be about 900 if the data were from the 1960 Census, and about 6,700 if the data were from the CPS. Projections for several occupations were within the range of sampling error for CPS estimates of actual employment in 1975. Projections for the following occupations were within one standard error of the estimate:

Compositors and typesetters
Asbestos and insulation workers
Crane, derrick, and hoist operators
Pharmacists
Dietitians and nutritionists
Airplane pilots and navigators
Cabinetmakers
Cement and concrete finishers
Furnace tenders, smelters, and pourers
Metal molders
Millwrights
Jewelers and watchmakers
Railroad conductors
Sailors and deckhands

If the measure is set at 1.6 standard errors of the estimate, projections for the following additional occupations are within the range of CPS sampling error:

Waiters and waitresses
Bartenders
Clergy
Meat cutters and butchers, except meat packing
Roofers and slaters
Heat treaters and annealers
Log and lumber inspectors
Locomotive engineers' helpers

Comparability of occupational employment estimates also is affected by other differences between the census and the CPS. Among these are the more extensive training and experience of the CPS enumerators than the census enumerators, differences in format of schedules, and differences in methods used to process the original data. In addition, occupational estimates from the CPS were annual averages of 12 monthly estimates, whereas the Census data were collected only for April.

Mr. **Gore**. Thank you very much.

I was looking at a report by the Carnegie Mellon Institute on the impact of technology on the workplace. Are you familiar with that recent report?

Mr. **Kutscher**. Yes. Is this the Ayres-Miller report?

Mr. **Gore**. Booz Allen.

Mr. **Kutscher**. I think it is based on Robert Ayres and Stephen Miller's work, though, isn't it?

Mr. **Gore**. Yes.

Mr. **Kutscher**. Yes, I am.

Mr. **Gore**. Yes, I believe that is correct. You may be more familiar with it than I am.

Here is the point that I want to make, based on their report: Table 4 of your testimony, attached to your testimony, entitled "The Following Occupations Will Account for Fifty Percent of All New Jobs Generated During the 1980's" lists secretaries as the occupation that you believe will be responsible for the most new jobs created, but the Carnegie Mellon report lists secretaries as one of those occupations, and it is a relatively small group, that will be affected the most by automation. They have a net loss or major transformation of 5 million jobs in that category. You have a net gain of 700,000.

To what extent do you believe that new developments in technology will diminish the number of new jobs which you now project in that category?

Mr. **Kutscher**. I guess I would argue for jobs like secretaries that it may change more the content of the job, and that they will have to be more familiar with word processing and other data processing types of equipment, rather than that they will be totally displaced from the work.

On the other hand, jobs such as stenographers are jobs that very likely will be very greatly displaced by new technology. Also, keypunch operator and data entry people are another set of clerical occupations that new technology very likely will cause displacements in the future.

Mr. **Gore**. Do you measure or project that change in job content?

Mr. **Kutscher**. No.

Mr. **Gore**. No?

Mr. **Kutscher**. Only to the extent that we can describe it in things like the Occupational Outlook Handbook. It is very difficult to quantify, so that in our statements in the Occupational Outlook Handbook where we describe the type of work that an individual does—our statement on the secretary from 10 years ago would be different than our statement on secretaries today because of the need to be familiar with word processing equipment.

However, we are not able to, then, go ahead and say the rate at which that will affect jobs in the future, because of changes in the functions of a job which are difficult to quantify.

Mr. **Gore**. Why haven't the folks at the Department of Labor complied with the mandate that was put into the law which we referred to earlier to create a nationwide computerized job bank?

Mr. **Kutscher**. I would really defer that question until tomorrow's witness from the Employment and Training Administration, Joyce Kaiser, because that is a responsibility of the Employment Service and not the Bureau of Labor Statistics.

I would just comment on one other aspect——

Mr. **Gore**. Well, you have some of that responsibility, don't you?

Mr. **Kutscher**. Yes. I was just going to comment on the second part of it, which is the responsibility—and the majority leader read part of the responsibility—to develop an occupational employment statistics program at the national, Federal, and State levels. I would just mention that that is in place and is part of the data base that we do use for developing our job forecasts.

Mr. **Gore**. Therefore, your colleague in the Employment and Training Administration, part of the Department of Labor, will have to respond to that in——

Mr. **Kutscher**. In the job banks part, yes.

Mr. **Gore**. Congressman Durbin.

Mr. **Durbin**. I have a fairly general question. It has always kind of puzzled me because I have lived through part of it, and that is that we talked about counselors earlier, high school counselors and the like, people who give advice to students on their way to making decisions as to what occupations are the real coming occupations in the years to come. Maybe this dates me a little bit, but I can remember Sputnik and everybody wanted to be an engineer. We were going to have electrical engineers, and we were going to conquer space. Then that seemed to pass, and we were flooded with engineers.

The next thing was teachers. We were going to have lots of teachers, and we got too many teachers.

Then I guess it was lawyers. It goes on and on. I am just wondering, are we getting any closer to the day where we can give a fairly accurate prediction in terms of numbers, how many will be needed in given occupations down the cycle, beyond that point where you are training the teacher, training the student, and expecting a fruitful work experience? Are we linking that up with the real world, passing that information on to the counselors, to the colleges? Is that being accomplished now?

Mr. **Kutscher**. I think in some cases it is. In areas such as teachers, because that was a long-term trend that resulted from the change in the birth rate, and it was fairly easy to predict that there would be too many teachers. We were able to put in the Occupational Outlook Handbook that teaching was not a good field to enter some years ahead of the turn in that.

On other things, when you get very pronounced shift in national priorities, such as moving from the space program to less emphasis on that program, it greatly alters the demand for engineers. That can happen in a very short period of time. I think that is one of the areas where short-term and medium-term forecasting is not always able to capture all of those changes. That is why we update the handbook every other year. Hopefully, we can capture that.

Mr. **Durbin**. The people who are reading it are making long-term decisions.

Mr. **Kutscher**. That is right.

The second aspect, of course, is this is only one element that individuals may use in choosing a job. We could say teaching 10 years ago was a poor field to enter, but, in a free society, individuals still choose to enter those fields, partially from lack of information, but also because they decided they liked the work and were willing to compete in the job market for the available jobs.

We constantly strive to do a better and better job of forecasting the changes in the economy, the changes in technology, and the impact that will have on jobs in the future, the near and long-term future. However, we make errors. I think there is no doubt about that.

Mr. Durbin. You make an observation on page 8 of your testimony about the growth of manufacturing jobs and you seem to tie it fairly tightly to growth in defense spending.

Mr. Kutscher. Well, defense and investment. I think the important thing to recognize is that manufacturing employment has declined in absolute terms, but in relative terms, say over a period like a decade, it has held fairly steady in terms of absolute levels.

The other element is there are still some industries inside manufacturing that have fairly dynamic job growth—computer manufacturing, medical and dental instruments, drugs. There are some elements of manufacturing that still do offer job prospects. This is not to play down the auto and steel problem, because they are there and they are very real.

Mr. Durbin. That is all I have. Thank you, Mr. Chairman.

Mr. Gore. You project 4 to 6 percent unemployment in your forecast; is that correct?

Mr. Kutscher. In the set that is described here, that is correct.

Mr. Gore. Do you think that is accurate?

Mr. Kutscher. I suppose most forecasters today are using a somewhat different long-term unemployment rate. What we hope to capture in our unemployment rate is to show the sensitivity of an occupational projection to a change in the unemployment rate. If we have a 4.5 and a 6 percent unemployment rate and the true unemployment rate is 7.5, the difference between our 4.5 and 6 would give one some idea of how certain occupations are sensitive to changes in the unemployment rate assumption or to other economic assumptions.

Mr. Gore. I remember back during the 1979 oil crisis we had an argument on another committee with the Department of Energy. Their energy model assumed that we were going to have a booming economy, and they felt it was only appropriate for them to assume that because you do not want to have a pessimistic view of the future. Yet, that single difference in their model made up the difference between a projection of an extreme shortage and a surplus. The fact is their projections were just badly wrong, and policy decisions were made based upon their projections which were wrong.

It seems to me that if you are wrong in your projection of 4 to 6 percent unemployment, the bias that injects into the rest of your figures could be a significant one.

Mr. Kutscher. That is probably true for at least some occupations that are very sensitive to swings in the unemployment rate. Other occupations, we find, are not that sensitive.

Mr. Gore. Suppose I am a young person interested in one of those that is sensitive. Wouldn't it be good for me to have that information?

Mr. Kutscher. Yes.

Mr. **Gore**. Is there any way you can do that?

Mr. **Kutscher**. One of the improvements that we have made in the Occupational Outlook Handbook in the current edition is to try to identify those very occupations—construction occupations being a case in point—that are very sensitive to changes in overall unemployment and also very sensitive to cyclical swings. So young people who are making judgments about that occupation do so with knowledge that they are entering an occupation in which the up-and-down swings are very large.

Mr. **Gore**. To what extent do you rely on data from the Occupational Analysis Division?

Mr. **Rosenthal**. The Occupational Analysis Division in Employment and Training Administration [ETA] develops the Dictionary of Occupational Titles. We actually do not use the Dictionary of Occupational Titles to develop information for the handbook. We use information from the Occupational Employment Statistics Survey that Mr. Kutscher mentioned earlier. We do relate the codes, the Dictionary of Occupational Codes, to the data that we collect so that other people who do use the Dictionary of Occupational Titles for a variety of different purposes can relate whatever information they have to the information that we have in the handbook.

Mr. **Gore**. Is it true that the Occupational Analysis Division was abolished because of budget cuts?

Mr. **Rosenthal**. I suggest that you talk to the people from the Employment and Training Administration who are responsible for that program.

Mr. **Gore**. Well, surely you know.

Mr. **Rosenthal**. I am not sure. There are some people still on the staff. As a matter of fact, within the past month, I believe, a supplement to the Dictionary of Occupational Titles was issued, so somebody is doing that type of work. Whether or not that work was done in that division or some place else, there are some people working on the DOT because a supplement was issued recently.

Mr. **Gore**. Have you had a significant impact on your programs for forecasting jobs because of cutbacks in the data collection efforts?

Mr. **Kutscher**. The data base that we use in developing the occupational projections has not been cut back significantly in recent periods, no.

Mr. **Gore**. All right. You presented, with your testimony, analyses of the accuracy of the BLS model. How would you characterize the strengths and weaknesses of your technique?

Mr. **Kutscher**. I think our technique allows us to capture the impact of changes in the structure of the economy, as depicted by swings in patterns of Government expenditures and consumer demand, and so forth.

When we get down to the point of how well can we capture technology and, more importantly, how well can we quantify it, project its rate of spread and its dispersion, I would think we would have to be honest and say that that is still largely judgmental. In some cases we do well, and in other cases we do not.

Also, the point made earlier by the witness from GAO—our past reviews have shown that we do very poorly on small occupations. Small occupations tend to have very significant rates of growth, sometimes increases, sometimes declines. Our pattern for developing projections, then, is that our accuracy is inversely related to the size of the occupation.

Mr. **Gore**. Is it fair to say that your technique gives a relatively reliable picture of the short-term future of broad occupational categories, but is far less reliable the longer you attempt to project and the narrower the occupational category you are dealing with?

Mr. **Kutscher**. I think that is a fair statement with the following qualification: I am not sure how short term it is, because in the short term you would be impacted by swings in the business cycle. I would say in the medium term it is probably reasonably accurate. It captures the major shifts in the economy, but obviously the more detailed the occupation you look at, the more likely you are to find one in which we have a great deal of error.

The second side of that is the further you go out in the future, the more impact technology can potentially have.

There are two errors that one can make in terms of forecasting technology. One is to assume that a new technology is coming into being and is going to have a great impact when, in fact, it does not; the other is you assume it is not coming in and it is introduced and does have a significant impact.

Mr. **Gore**. Yes.

What impact do you think your projections have?

Mr. **Kutscher**. We know that the Occupational Outlook Handbook is widely distributed throughout high schools and colleges. The Educational Testing Service has done an evaluation, and it is the most sought piece of occupational information by high school students, so that they do seek out that information.

What is difficult to say is how influential is it in a final decision that a student makes to decide to be a computer programer versus a dentist.

Mr. **Gore**. If it is the most sought-after body of information by young people, wouldn't it make sense to include a projection of new occupations that are being created or are likely to be created by technological developments? It just seems like such a missed opportunity. If your methodology were slightly different, if it were supplemented by some of the more innovative projection techniques that are capable of looking a little bit farther down the road and taking into account some of these discontinuities that a linear projection will not pick up.

It might be much more useful for young people who are looking at this as a guide for their careers.

Mr. **Kutscher**. I think it would if you could make sure that you are not at the same time giving very misleading information.

Mr. **Gore**. Yes.

Mr. **Kutscher**. The question is on new and emerging technologies, to what extent are you placing a view of the market that is all out of proportion to the number of jobs available. If you look at a job like robotic technician, the question is—the Carnegie Mellon study that you mentioned earlier and another one by W. E. Upjohn estimate that there will be about 100,000 robots in place by the end of this decade. In order to achieve that, we need 40-percent annual growth in the number of robots put in place.

The question is, then, how many robots technicians do you think we need over this period to service those 100,000 robots.

The second thing is we have done some studying of robots, and we find that, where they are in place, the people who are in fact servicing them or repairing them tend to be industrial machinery repairers, which are individuals already on the work force of the employer and who can, in fact, repair the robot and many other automated machines, that the manufacturer has. Therefore, I think we need to be very careful about putting in new jobs and not putting them totally out of perspective.

Mr. **Gore**. I think that is a useful statement.

Does minority counsel have questions?

Mr. **Rheem**. No questions, Mr. Chairman.

Mr. **Gore**. I would like to thank you, Mr. Kutscher.

Your colleague from the Employment and Training Administration will be here tomorrow. We will direct the question to her concerning the computerized job bank. We will look forward to tomorrow's testimony.

We will convene at 9:30 tomorrow morning in this room.

I would like to thank all of our witnesses that appeared today. We will now recess until tomorrow morning at 9:30.

[Whereupon, at 2:11 p.m., the subcommittee recessed, to reconvene, Thursday, April 7, 1983, at 9:30 a.m.]

JOB FORECASTING

THURSDAY, APRIL 7, 1983

House of Representatives,
Committee on Science and Technology,
Subcommittee on Investigations and Oversight,
Washington, D.C.

The subcommittee met, pursuant to call, at 9:30 a.m., in room 2325, Rayburn House Office Building, Hon. Albert Gore, Jr. (chairman of the subcommittee) presiding.

Mr. Gore. The subcommittee will come to order.

I would like to welcome our witnesses and guests. I have a brief opening statement. This morning we begin the second day of this subcommittee's hearings on job forecasting. The techniques of job forecasting can help us predict what new jobs are likely to be created by advances in technology, as well as how existing jobs will be changed or even eliminated by automation.

Yesterday, we heard from several witnesses that accurate and farsighted estimates of these trends are absolutely critical to the design and redesign of educational programs to meet the needs of tomorrow's jobs.

But we are also told that the methods now used by the Bureau of Labor Statistics to follow changes in the U.S. work force are too limited in scope. They do not give us a clear look forward at the new skills emerging industries will require. Nor do they tell us what jobs will be eliminated in declining industries.

We also heard suggestions from leading occupations forecasters about new approaches to predicting future jobs. In yesterday's testimony, we learned from the majority leader, Congressman Jim Wright, that the Labor Department has not yet been able to design an effective national labor market information system.

Such a national computer data bank could be used to disseminate information about available jobs to unemployed people all over the country and assist in matching people to those jobs.

This program has been called for, both in existing CETA legislation and under the new Job Partnership Training Act. But such an online, readily accessible data bank has never been implemented by the Labor Department. This is an area which this subcommittee will continue to examine with great interest.

Today we turn to questions about the potential impact of job forecasting. We will look at the connection between predicting new jobs and developing the training and retraining programs to prepare America's workers for those jobs.

American industry is now attempting to revitalize itself, to pull itself up by its bootstraps and to focus on increased productivity here at home and more effective competition in markets overseas.

Some of the changes required for this revitalization involve the use of new technologies; everything from robots and computer-controlled equipment to molecular biology. We face severe problems along the way to economic well-being, however, and in particular, in exploiting these emerging technologies.

Chief among them is the serious and chronic shortage of trained scientists and engineers. This session of Congress, with the passage of the Emergency Mathematics and Science Education Act, we have finally begun to seriously address this issue.

But nowhere is the problem of adjusting to and preparing for the realities of these new technologies more acute than in the workplace itself, among people now at work on assembly lines and in factories.

Already, due to a combination of rapid technological change and the current recession, an estimated 2 million of these workers have been displaced, or laid off, from their jobs. Within 20 years, according to one estimate, the total number of these traditional manufacturing jobs could shrink by 50 or an even larger percentage.

No matter how successful America's industrial transformation is, or how quickly it takes place, most of the future jobs created by technology will of necessity have to be filled by today's workers. People at work today will still make up 90 percent of the working-age population in the year 1990 and three-quarters of those that work in the year 2000.

In a very real way, then, the success of our new economic initatives will depend on our ability to put displaced workers back to work, to train them for jobs in the emerging sunrise industries, and to keep on retraining and educating American workers as the requirements of work continue to change in the years ahead.

This morning, we will consider the opportunities and challenges of retooling not just American industry, but American workers as well. Our witnesses have had wide and varied experience with the problems of retraining and adapting to new technologies.

Some of them are economists, others direct or administer training programs, and several do the actual training, day-in and day-out.

I want to thank all of our witnesses for coming and before introducing our first panel, I would like to call on the ranking minority member of the subcommittee, Mr. Skeen.

Mr. SKEEN. Thank you very much, Mr. Chairman. I have no extensive statement. I would like, however, to make some observations.

With a great deal of interest, we heard yesterday from people who are vitally interested in this particular issue. Starting with the majority leader and on through those who gave us some insight from the private sector, we learned just how these recognized experts feel. I think they did an extraordinary job.

The testimony pointed out a fundamental problem that we have in the Congress of the United States. Those of us in Congress always feel that there is something that we can do. However, we do not know what we should be doing, or how we should be doing it.

Those of us who have all the answers in this body finally have to rely on the private sector—the people whose job it is, day-by-day, to really know what the situation is—to come before these committees and give us some direction.

We appreciate that and we welcome you. I particularly want to welcome the gentleman from TRW since we have a little family involvement. My brother worked for TRW some years ago. We appreciated it; it kept him off the streets. He now works for Hughes. I do not know whether that was progress or regression, but we do welcome you here today. We appreciate the contribution you make by helping us decide where we ought to go and what we ought to be asking the Department of Labor.

So thank you, Mr. Chairman. I may have to leave a little early, we have a simultaneous meeting. Scheduling is always great around this place, but thank you very much, and welcome.

Mr. GORE. Well, we are delighted to have both of our witnesses this morning. Pat Choate is senior economic analyst at TRW, Inc., and a futurist in his own right and well known in that regard.

William Kolberg is not only President of the National Alliance of Business, but also a former assistant secretary of labor for employment and training in the Nixon and Ford administrations and was with President Reagan just yesterday in Pittsburgh talking about these very same issues.

Speaking of TRW, I am proud to have a large TRW facility right in the middle of the congressional district and we are mighty proud to have you here for that reason as well.

Without objection, we will put the prepared written comments of our witnesses in the record in full and we will invite you to proceed, beginning with you, Mr. Choate, with such presentation as you feel is appropriate.

STATEMENTS OF PAT CHOATE, SENIOR POLICY ANALYST, ECONOMICS, TRW, INC., AND WILLIAM KOLBERG, PRESIDENT, NATIONAL ALLIANCE OF BUSINESS

Mr. CHOATE. Thank you very much, Mr. Chairman. I am very pleased and honored to have the opportunity to share my thoughts with you this morning.

What I might do is take about 5 or 6 minutes and give a quick overview of those thoughts and save the rest of the time for such questions as you might have.

Mr. GORE. That would be fine.

Mr. CHOATE. The basic point that I want to make is that the United States and the world economies are undergoing very profound structural changes and that as a consequence of those structural changes, it is going to be necessary, I believe, for both the public and the private sectors to take some different views on how they approach training.

I think it is becoming increasingly obvious that how well and at what pace we undertake that training is in large measure going to determine how well we are going to be able to rebuild the economy, as you indicated in your opening statement.

I think that there are four of those structural changes that we are going to have to give explicit attention to. The first of those are the demographic shifts, the point that you made earlier. The workers that we have today are going to be the only workers in large measure that we are going to have to work with for the next two decades. So how well we can retrain them becomes important.

The second issue is going to be be the increasing importance of international trade to the U.S. economy. The importance of that, I believe, is that American initiative is going to find itself under very intense competition from well-organized, well-financed and technologically advanced competitors, certainly for the rest of our lifetimes.

The third issue is really going to be the galloping pace of technology, and again, one of the things that happens, as you see the spread of technology, as the price comes down, as it becomes ubiquitous is that everybody soon has technology and it becomes very important to distinguish between the physical life of a piece of equipment and its economic life. Increasingly, they are not the same.

A piece of technology is being replaced quicker than truly its useful life. That has very important implications under the work that is dependent upon that technology.

Finally, there is the pace of change itself. The pace of change is accelerating. My favorite little example of this is to talk about slide rules.

When I was in college, anyone who was in engineering or sciences had to have a slide rule. I mean, it was just de rigueur. You had to have the slide rule.

The New York Times reports that last year, K&E, the largest manufacturer of slide rules in the world, made 100 slide rules. Well, the point is that what we have seen is computer electronic technology has replaced that and that type of change is occurring, I think, in most industries.

I think what we are going to see is probably an acceleration, each new advance supplants the technology that was before it, it changes the whole cost structure; it changes the very nature of work in many cases.

On the other hand, I think because of this slowdown in the birthrate and because of the slowing expansion of the work force, what we are also going to see, and I think that the occupational long-term projections are correct, is we are probably going to have enough jobs for everyone that wants to work into the foreseeable future that is maybe different, they may be in different places, and I am very much of the view, from reading various studies, that there probably are going to be jobs that most people can do. They are going to be less of the high-technology jobs. They are going to be doable jobs that people can be trained for.

The challenge that we have got, though, is given this fast-pace change, how are we going to get them trained? Who is going to do the training?

In that, I think we have got to recognize that there is a shared public/private responsibility and in that, I think that increasingly our public education systems are going to be modernized and increasingly, we are going to have to rely upon the private sector to do that training now.

I can give it in very quick and succinct form. The private sector today does about three times more, in terms of expenditures of training, than the public sector, Federal, State, and local put together. If the AST, the American Society of Training and Development, numbers are correct, the private sector is putting up about $30 billion today on training. The public sector is putting up around $10 billion on training.

But the majority of that training is by the major firms, the large firms, your Fortune 500 firms. Yet, on the other hand, you are having a big chunk of the new jobs that are being created by medium- and small-sized firms.

The issue is, how do we set up incentives in this country so that the medium- and small-sized firms, and the bigger firms as well, can do more training? One of the things that happens under technology is that the technology is proprietary. It is tied into a specific firm.

On the other hand, we are caught with the challenge of the displaced worker that is outside that system altogether that will need retraining. The question is, How do we retrain those 2 million workers? That may become many more workers over time and second, or third, I guess, is How do we engage the 2 or 3 million people that will be coming into the work force, or turning back over in the work force and having retraining?

To all of this, information becomes important. Information, in fact, becomes central. If you cannot project the future in finite terms, and I do not think you can in the long term, then the issue becomes one of how do you change the system so it can meet with the demands in the short term.

In other words, how do you build flexibility on the supply side, as opposed to trying to get a finite projection on the demand side? Particularly, how do you do this at the local level and how do you do this on the short term? How do you set this up in such a manner so that in much of this short-term training, the workers can know, as they are thinking about getting retraining, what the jobs are going to be, first locally, then in a State, then in a region, then national, and second, how can you set it up in such a way where the State governments, where they are operating the public training programs and the local governments, how can you set it up in a way where they can have the flexibility to be able to offer modernized training?

What happened in this country in the 1960's and the 1970's, we built a great training system with our vocational schools, our community colleges, and while the buildings are still modern, increasingly I think we are finding that the equipment is not. And in many cases, the faculty need to be retrained.

How do we modernize that? How do we do it in a cost-effective way? I think one of the other speakers I see here, Dr. Francis Tuttle, can speak to that very well, how one State is doing it. It also turns out that the most flexible and the fastest way is also the cheapest way.

So in sum, I would say that we have program structural changes. We are going to have to find a way to give incentives for the private sector to do more of that training and I think there are some things that we can speak about towards that. We are going to require some new ways to provide financing for the training of the displaced worker, which is a major new structural shift, and which I do not think our present systems are set up to deal with.

Then, finally, there is the question of how we are going to modernize our existing vocational, technical, and community college system, and central to all of that, to do this efficiently in a time of limited capital, is how do we set up some particularly short-term information systems to be able to project what is needed.

So with that, I turn my time back, sir.

[The prepared statement of Mr. Choate follows:]

ST097051-1

Testimony
of
Pat Choate
Senior Policy Analyst, Economics
TRW Inc.

The SubCommittee on Investigations and Oversight
Committee on Science and Technology
U.S. House of Representatives
April 6, 1983

Mr. Chairman and Members of the Subcommittee:

I am honored and pleased to share with you my thoughts technology and the work force.

I will divide my comments into two parts: (1) a brief overview of structural changes underway in work and demography; and (2) A brief overview of the nation's training system, including a brief exploration of some key actions that now seem appropriate and timely. I will devote particular attention to the information needs we now face.

Structural Change

Both the world and the American economies are undergoing profound structural economic changes. The evidence of these changes is found in the decline of some industries; the rise of others; and the growing inability of our businesses and workers to make needed adjustments smoothly.

Essentially four basic structural forces are now transforming the economy. The first is the demographic shift in the work force. The second is the growing significance of trade and investment to the U.S. economy. The third is the growing influence of technology. And the four is the quickening pace of change. All are important; all are linked; all must be considered and accomodated if the American economy and American workers are to remain prosperous.

Demographics -- Of all the variables of change, the most predictable are those associated with demographics. Here we can accurately assess present and prospective conditions. For example, we know that the overwhelming majority of the American work force for the next two decades is already here; that most are adults today; and that most are already at work. The baby boom generation has matured.

In short, for at least the next two decades, today's workers will also be tomorrow's workers. How well we train and retrain them will in large measure determine how well our economy can perform.

That will not be an easy task. Specifically, we know that perhaps as many as one of every five American adults are functionally illiterate -- unable to read, write or count. Perhaps as many as 10 percent of all adults have alcohol-related problems. An unknown number have drug problems.

We also know that because of the aging of American population the most productive core of the work force -- the 25-44 age group -- will soon constitute over 50 percent of all workers. This offers major potentials for improved productivity through improved worker performance, but only if the workers can be adequately prepared.

Expanding Trade and Investment -- As we all know, trade and investment has become a major component of the U.S. economy during the past 20 years. During that period, the value of trade and investment has leaped from approximately 10 percent of the Gross National Product (GNP) to over 25 percent.

This is simultaneously creating challenges and opportunities. The effects on firms and workers of foreign-based firms penetrating traditional U.S. markets is highlighted by the difficulties of the steel and automobile industries. The potential for new jobs is also highlighted by foreign investment in the U.S. and the export of American products, such as agriculture goods.

Ultimately, the opening of the U.S. economy means that U.S. firms must become more competitive: domestically and internationally. And such efforts must include attention to modernizing and improving the skills of the American worker.

Technology -- Technology advance has long been a mainstay of American productivity growth and enhanced American competitiveness. Yet, competitor firms in other nations are increasingly creating technology that is equal to that which U.S. firms are producing. Ultimately all will benefit from these advances. However, there may be some who are displaced in the process of its introduction. While the advantages of technology are clear, what to do about displacement of workers is less obvious.

Fortunately, it is almost certain there will be enough jobs for all who wish to work. This is confirmed by projections of the Bureau of Labor Statistics and the Department of Defense. Moreover, most of these jobs will be jobs for which most workers can be trained.

This issue of technology and the skills of workers is not new. It was at the center of the debate on automation 25 years ago. Perhaps the best answer then and now was provided through a series of research projects conducted by Professor James R. Bright of the Harvard Business School.

Based on his studies, he devised a 17 step hierarch of mechanization based on the differing degress of mechanical accomplishment of machinery and the varying degrees at which machines complemented or supplemented the activities of workers. Bright's case studies and analyzes led him to the conclusion that automation does not necessarily lead to a lack of opportunity for the unskilled worker.

Rather as work becomes more automated, there is actually reduced demand for greater skills of the average worker -- a de-skilling process. Thus as work becomes more automated, particularly with "smart" electronics the demands placed on workers in many jobs will actually be decreased.

As measured on Bright's hierarchy most of today's jobs in all industries are still in the low to middle stages of skill demands. Irrespective of the correctness of his hierarchy, the general implications of his argument are important. First, it means that the economy is far from become robotized. Workers will be needed.

Second, it means that the demands on workers entering new jobs may not be high, just different. Many of today's workers can be retrained.

Third user-friendly technology becomes one of the best aids a low skilled worker can have -- making up for skill and educational deficiencies.

Fast Paced Changes -- The final structural shift that must be recognized and accommodated is the apparent acceleration in the pace of change. Microelectronics, machines that can walk and see, and automated factories and offices are rapidly reducing the time between one advance and the next one that overtakes and supplants it.

In such conditions of change and the uncertainty it brings, the principal route for firms, workers and nations to confront the inevitable challenges of such change is to improve their ability to adapt. Simply and bluntly put, those who can adjust quickly will also be more likely to adjust well; those who adjust slowly will surely fall behind.

The Training System

The nation's training system is composed of several components: (1) the training systems; the financing systems; and the information systems. Each are important.

The Training Systems -- The principal training system in the United States is operated by the nation's employers. Although precise estimates of their training expenditures do not exist, the American Society for Training and Development places it at the $30 billion level. Put in perspective, this is approximately 3 times the level of all federal, state and local training expenditures on non-defense training. Also, proprietary education and training institutions are major participants in training activities.

Today, the linkage among and between the public and private training institutions is confused. Perhaps the best illustration of this is found in a study prepared by the General Accounting Office on the training programs in one community -- Tidewater, Virginia.

The GAO found that Tidewater had 44 distinct training programs involving 5 federal departments, 3 independent federal agencies, 1 federal regional council, 26 national and state organizations, and more than 50 local administering agencies. While the new Jobs Training Partnership Act will help reduce some of this duplication, it will not reduce anywhere near all.

Fragmentation is simply a fact of life of American federalism. The challenge is devising the information and management techniques needed to cope.

Another facet of the public sponsored training is the growing obsolescence of parts of the public training system. In the vast expansion of the nation's training capacity in the 1960s and 1970s, thousands of new buildings for training were constructed and equipped. While the buildings remain modern, much of the equipment is not. As a necessary consequece of a head-over-heels pace of technological change, the equipment of the 1960s will simply not be modern enough to train people for the jobs of the 1980s. Ways and means must be found to modernize this equipment -- likely through a combination of public-private efforts and through some changes in federal legislation such as the Vocational Education Act.

Financing -- As noted previously, most of the financing for training today comes from private employers. Of that publicly sponsored training, the overwhelming majority comes from state and local governments: over $6 billion of the almost $10 billion of public training expenditures in 1982. Moreover, when the CETA expenditures of 1982 are excluded and only vocational and technical education expenditures are counted, the state and local governments provided more than 90 percent.

The basic challenge now is how in an era of tight budgets are private firms to be encouraged to spend more on training. And then how is the nation to insure that the public training funds are spent well, which leads me to the last element of the nation's training system -- information.

Information -- Since the first day of these hearings were devoted to an examination of the nation's occupational projections and job-match systems, I will not describe what exists. Rather, I will describe what is now required and why.

In a period of fast-paced technological and international change, our ability as a national economy to compete will increasingly be dependent on our abilities to adjust to changing realities. That means for workers that they must be prepared to retrain, even relocate. At the same time, the nation's training system must stand prepared to provide that training in an efficient timely manner using state-of-the-art technology and techniques.

If that is to be, the quality and availability of basic information about job demands and workers must be improved. Specifically, workers require timely information about the demands of jobs, their availability, when and under what circumstances. They require good information if they are to wisely choose which training to take. Most important, they require good information if they are to improve their prospects for fast reemployment using their existing skills.

The training institutions require timely information to determine their course offerings and to make decisions about which faculty and equipment to secure.

A number of states, such as Oklahoma and South Carolina, are attempting to meet the needs for flexible, state-of-the-art training through a number of actions. First, to insure that training institutions have state-of-the-art equipment, these states have created state-owned and state-operated equipment pools. The state assumes responsibility for buying and/or leasing that equipment, moving it to institutions that need it and then moving it again when demands change. These states also maintain a pool of money to hire instructors outside the system when training by specialists is required.

What these states have done explicitly is acknowledge that the future is simply impossible to predict -- particularly the 5 to 10 year future. In such a circumstance it is much too expensive to equipment every institution to meet every likely demand.

Thus, in the absence of reliable long-term demand information, they have adjusted their "supply" capacity to meet whatever the demands might be. By the economies of state equipment pools, it also turns out to be the least expensive route.

However, the key to the success of these systems is reliable short-term information that can be used to guide training programs. Accordingly, these states have on the staffs of the training institutions what in effect are Account Executives. These people go to employers in their service areas and on a regular basis determine what the employers will be needing in the short term -- today, a month, three months, nine months, etc. Since many training demands only require short-term training, these facilities are able to respond -- particularly since they have the flexibility provided via the state equipment pools.

Most state training systems could adopt such a program. Indeed, over 30 states now have some experience with a variant of such programs that are called the "customized" training programs or "quick-start" programs -- program that assist firms with new start-ups or expansions. But in all these cases, the key is quick, fairly-reliable information.

Good information, long-and short-term, is also critical to the nation's 85,000 counselors. After all, how can they give good counseling on poor information.

Finally, and most important, it does seem timely and appropriate to take actions to assure that job-seekers have access to some form of a state and national job bank. As I am sure you will have heard in previous testimony, many workers can be assisted back into the work force with little or no training if only a better match can be created between employers who need workers and workers who need jobs.

While there are some technical questions that must be resolved, such as which occupations should be included and how should the state systems be linked, these are second order issues. Technologically, the improvement of these matching systems is feasible on a cost-effective basis.

Summary

In summary, Mr. Chairman, the U.S. is and will continue to go through major structural changes. The best and least expensive means to cope with these changes, even profit from them, is to be able to anticipate and rapidly adapt. Central to any national, state, local or private adjustment efforts must be a strengthened capacity to modernize the skills of the American work force. And central to that task is the available of reliable information on where the jobs are and will be and who is available to do that work.

In a fragmented federalist system, good information is not only central to improving the match between employers and job-seekers, it can help policymakers and administrators gain an oversight not now possible -- improving the use of what are increasingly limited public resources.

Fortunately, the legislation required to improve the nation's training information exists. What is now required are direction and funds.

I applaud the leadership of you and this Committee in exploring this most important topic.

I also appreciate this opportunity to share my thoughts with you.

Thank you.

Mr. GORE. We will hold up on questions until Mr. Kolberg has completed his presentation. We are delighted to have you, Mr. Kolberg, please proceed.

Mr. KOLBERG. Thank you very much, Mr. Chairman.

As you mentioned, we are just returning from a national conference in Pittsburgh, so I do not have a prepared statement, but I will try to summarize 3 busy days in 10 or 15 minutes.

The conference was called the National Conference on the Dislocated Worker. I think you have at the podium the conference program. We were very proud to sponsor this, along with 12 cosponsors, the AFL-CIO, 4 other business organizations, 3 Departments of the Federal Government, the Governors Association, the National Association of Counties, et cetera. You find those on the first page there.

Mr. GORE. Yes.

Mr. KOLBERG. The purpose of having the conference, and this is the other end of what Pat is talking about, is to examine the effect of this dislocation that he is talking about on human beings. What do we know, what are we doing, what is good practice?

As Mr. Skeen said, is there a role for the public sector that it ought to be addressing that the private parties cannot address, and what is that role?

This was a working conference, as you will see if you page through here. We had 700 people come to the conference from all across the United States representing all the parties: labor, management and government, and all levels of government.

If you page through here, you will find that we had 100 people on the program. We tried to put together the experts from wherever they were to come together and share ideas. We also brought people from Western Europe and from Canada to share their experiences.

John Dunlop gave us the keynote address and I think the most important thing John said has really already been said by Pat. That is, that dislocation and change is the price we pay in this free private economy for progress and that one does not want to freeze things at all but one wants to plan for dislocation and change in the very best and most effective way one can.

One of the first and most important things in this conference was to bring together the private parties, apart from the Government. What are the private parties doing? What is good practice now? How has that changed? Just a few comments on that.

We heard from the Business Roundtable, for instance, the Business Roundtable has had a task force for several years on plant closings. They are about to issue a set of principles. Now, clearly, if you are going to help people, you have to have some early warning and a whole range of other things.

I could go through these seven principles the Roundtable is now about to say to their members. Clearly, the longest practical notice for a plant closing or a major layoff is absolutely crucial to be able to do anything at all. Communications: let's see if we can have a situation where there are no surprises so management and labor are communicating, hopefully positively, and then moving on to the variety of things that management can do to aid the adjustment.

The NAM has just finished a survey of 1,500 of its members. Surprisingly and heartening to me, half of the major companies now in the United States have contract agreements with their labor organizations that spell out early warning, that spell out the relationships between management and labor, and put together a set of programs and relationships that will help dislocated workers as this happens.

I think the point to be made here is there is a lot going on. It has not been summarized; we have not generalized about it very well, but the private partners are communicating. There is now a developing sense that we are going to have a great deal more dislocation than we have had in the past, and the private parties are busy, correctly busy, bargaining about that and setting forth their relationships beforehand.

When the managers from the Ford Motor Co. and the chief executives from the UAW talk on a panel about their relationship, what they have done in their contract, their training and retraining setup, clearly they are excited and there is a positive relationship there.

I think GM certainly has emulated that as well: we have a totally new labor/management climate in that industry. We heard from Bethelem Steel. Bethelem has just begun on the same kind of thing, helping in the adjustment process with the steelworkers.

We heard from Eddie Carlough, the president of the Sheet Metal Workers, who talked about the program the sheet metal workers have with their employers, as with Ford. They set aside three cents an hour in that case, to take care of the whole range of adjustment and readjustment programs.

I could go on down that list. We heard about GE, the DANA Corp., Goodyear. We heard from State bodies of the AFL-CIO, the National AFL-CIO, and its Human Resources Development Institute which has a number of programs going.

I think in summary, on that piece of it, there is a great deal going on in the private sector, apart from government, that would go on in any case. I think the private parties are beginning now to develop new arrangements to handle this emerging problem.

But then moving on, adding now the government to this set of private parties, as I said earlier, we heard from people from Sweden and Germany. This is not the time to go into the full panoply of employment training, relocation programs that those countries run and have run for years, but we thought it was important for the conferees to know that a total smorgasboard of well-run government programs, highly institutionalized, has been going for 20 or 30 years there.

We heard from the people in Canada who run the Manpower Consultative Service. Canada has run now for almost a decade a service out of its Federal Government that is essentially a catalytic service where the Federal Government provides experts to move into a community when there will be plant closings or major dislocations and to help organize a communitywide response between the private parties, bringing together everyone without being precise on what they do, it is the whole panoply, job clubs, training and retraining, relocation—the whole range of things.

Certainly what the Canadians have done is worth taking a very close look at. We heard what is going on in some of the States before JTPA and title III.

California has run a very fine program, Statewide now, for about five years, and has had a lot of experience. They have a number of relocation centers across the State. The new administration in California is very excited about this program, also, and intends to continue with it.

Again, I will not take up the committee's time to describe what that is. Iowa has done the same thing, so there is some State experience on using public resources to supplement the private resources to assist in this dislocation adjustment process.

Moving on to the cities, there are some examples of good operations where local government has moved into assist: Des Moines, Iowa, is one where the mayor's task force on plant closings has turned out to be a very effective program in that area.

There are others—St. Louis, the downriver community conference in Michigan, and I could go on in that vein, but I wanted to illustrate that there are some case examples now where there has been movement and good work.

If I could quickly turn to techniques and programs, the conference looked at, first and foremost, the question of stress. It is clear in a situation of this kind that people need to go through the psychological adjustment, sometimes almost a medical adjustment, of the stress that goes along with losing a job or with a plant closing down, and essentially a whole community closing down. We looked at the kinds of techniques that the AFL-CIO has developed, and some local bodies have developed, and clearly we will need to learn more about that.

Second, Pat has already talked about this, the need for better labor market information. It is a free private labor market; every one of us have to learn how to adjust. Information is the best way to help us make our own decisions.

We need to do a better job with labor market information. It is not that we have not tried for many, many years; we talk about the job banks. When I was in the government, we thought we were putting together a national job bank and we are still at it 10 years later. It is not very effective, it has never been used very much. It is not just the government's fault. Private employers do not have much faith in government mechanism, they do not want to be forced to list jobs. They distrust the government in terms of giving very much information, so private employers, I think, are the key to this.

If we can convince the employer community to list jobs so that, in fact, they could be put in a bank it would be a useful thing for them to do and it would help them get their job done. Then I think a job bank kind of mechanism will work.

Clearly, we need to do a better job of providing information to individuals so that they know whether it is worth relocating. If I relocate, is there a job? What kinds of jobs? What kind of training do I need? That whole range of information is absolutely crucial.

Obviously, we have talked a great deal about training and retraining techniques and again, I am taking up more of the committee's time than I should, so I will not go into that.

Finally, we focused on the new title III of the Job Training Partnership Act. I think the Congress wrote a very good title. I think the thing I like about it is the Congress of the United States did not try to tell States and localities what they should do; you set forth a number of very flexible instruments, some ideas about things that ought to be considered, but essentially said to the States and the localities, here are some new resources to be used on these people. Figure out for yourself what works for you, what you really need, and how to go about it.

That process is now just beginning. As you are all very well aware, you have made available $110 million in the last 3, 4 months for this program. The last 85 was in the job creation bill that was just passed and signed by the President.

There is some experience, and you will hear from Joyce Kaiser and others who were at this conference and who can speak very knowledgeably about what is going on at the local level with these funds. Private industry councils are beginning to get some experience with these funds.

My sense is, although you hear a lot about whether there is enough money out there, there is certainly enough money in my judgment for now, because we are just beginning. There are some models, but it is a very early stage of getting the States to understand this new responsibility, to get them to begin to relate to the private parties, companies, and unions, and to begin to put some programs in effect that make sense for them.

So I would not throw a whole lot of money after this problem for awhile until we get a bit more experience on what works and what does not.

What is going to be doubly difficult this year, as the committee knows, is that not only are we trying to set up new dislocated worker programs, but at the same time, we are trying to put the new Job Training Partnership Act into effect, create new private industry councils across the country, get new business volunteers involved. That whole process of transition, which is terribly difficult and complex and time-consuming, is taking place at the same time that we are asking the States and localities to move very quickly on this new dislocated worker program.

I think with that, Mr. Chairman, I would be happy to answer your questions.

Mr. **Gore**. Well, thank you both very much. I will just ask a couple of brief questions and then turn to my colleagues.

Let me ask you, first of all, do you both agree that, No. 1, our economy is undergoing a transformation, a period of transformation that is without precedent in history? Do you agree with that?

Mr. **Choate**. I would extend it, I think it is going to continue to undergo this type of transformation for the rest of our lives.

Mr. **Gore**. Mr. Kolberg.

Mr. **Kolberg**. Our keynoter said that we are going to have as much change in the last 20 years of this century as we had in the first 80. I think some of us thought change came pretty fast in the first 80, but clearly, you are correct, Mr. Chairman.

Mr. **Gore**. Second, one effect of this transformation will be to displace many millions of American workers from jobs they now have and create new jobs for which they may not have appropriate skills unless we act. You both agree with that?

Mr. **Choate**. Yes.

Mr. **Kolberg**. Yes, sir.

Mr. **Gore**. Third, in order to fill the new jobs that will be created by new technology, we must recognize the need to work with those persons who are presently in the work force. Most of the people who are going to fill those jobs are already in the work force. That is something that you both agree with.

Fourth, if we are going to have any hope of gearing up the sort of massive retraining of effort in this country, both private and public, that we clearly need, we must have more accurate information about the categories of jobs that are likely to be created with some indication of the timeframe that we are dealing with for each category. As a result, that means we must have better job forecasting techniques.

Do you both agree with that?

Mr. **Choate**. Yes, sir.

Mr. **Kolberg**. I do.

Mr. **Gore**. OK.

Mr. Skeen.

Mr. **Skeen**. You sort of left that hanging, Mr. Chairman.

Mr. **Gore**. I am going to come back to it.

Mr. **Skeen**. I figured you would. I would like to follow up with it, because as I gather from the testimony yesterday and today, a common element that runs through yesterday and today's hearings is that we are very happy with the things the way they are. We resist change, it is always very traumatic for us.

We are told from the time we are young that if you prepare yourself to be a professional of one kind or another, or an engineer, that you have a lifelong job. As an aside, I was very interested in what you had to say about the slide rules. I carried one around for a number of years. That was the badge in those days; they do not even make them anymore.

Mr. **Gore**. Will my colleague yield?

Mr. **Skeen**. I will yield.

Mr. **Gore**. I noticed in the Drug Fair recently that they have got a new slide rule out that has an electronic calculator built right into it. You can use it for a straight edge, that is about the——

Mr. **Skeen**. And get accurate numbers as well. It adds to the argument, what do you want to do, digital or logrythmic equations? I think it goes back to part of the discussion we had yesterday about education. I am not going to prolong this question, but we have asked the Department of Labor, we have asked our teaching profession, to become more and more specialized.

The trend I see is that we need to generalize more, add more flexibility, both in our educational system and the way we train professionals, and the way in which we prepare individuals for the kinds of jobs that come up.

We have asked the Department of Labor to give us some method of forecasting where these displacements are going to be, what the skills are going to be required and so on, and they tell us that they are not doing it very well—or we are telling them that they are not doing it very well—or at least with a great deal of accuracy.

Can you suggest to us in government a way in which we can bracket this thing and maybe not ask for so much specific information, but rely on other kinds of data that will do a better job?

Mr. **Choate**. I think the bracketing argument is really the way to go because it becomes a question of what kind of information do you want for what kinds of purposes? You want it really for policy purposes, I think, at the national level. Then as you move on down to individuals, they want to get very specific.

When one takes a look at the long-term occupational projections, they are probably accurate enough when you get to it, because they tell a picture—or they paint a picture—that says there are going to be a lot of jobs in the country; they paint a picture that says not all of these jobs are going to require a Ph. D. from an engineering school to do that work; but what they also say is that if most workers are going to fill these jobs, they can take some of the skills that they have now, with some additional retraining, and they can get across from today's jobs to tomorrow's jobs. They can take that translation.

So for the long term, I think those projections are probably quite good. Now we have boiled it all down a little bit narrower and we come into, let's say, some shorter term projections as you come into State and regions.

Here the challenge is one of providing administrators with sufficient information so that they can know how to modify their training institutions. Here I think the key has to center around faculty, the selection of programs, the type of equipment that they are going to need.

Some States, as some of the later speakers will speak, have a system where what they simply do is they go and ask employers where their demands are. In very short term, they are account executives, in effect, where you have somebody who serves a territory—it is like a county agent system where you work a territory, you ask the personnel officers what you are going to need in 3 months, 6 months, 9 months, a year, and you design your programs to meet those particular needs. Much of this training is going to be able to be done in the short term.

Here, again, what you are speaking to is you do not need information, I think, that is accurate to the fourth decimal place. What you need is a sense of what a specific firm needs in a specific short period of time.

Now, as you are able to set up that kind of a system where you can have account executives to do that, where you can get some job projections, where you can work with the firm to help design the training so that the training itself relates to a very specific sort of task, then the job becomes doable.

The other point that comes to it is if we can create more incentives for firms to do the training, I think what we will find, as the firms introduce the new technology themselves, they will have workers that will be good workers, that have a vested interest in the firm, that the firm itself will help them make the translation.

So it seems to me that what we are talking about is not, you know, information down to the fourth digit. What we are talking about is that which is pragmatic and that this is doable.

Mr. Skeen. In other words, what you are saying is that we need to understand what all the options are and we need to telegraph those better, rather than saying we can tell you within the fourth digit what is going to happen. These are the parameters in which we are going to be operating with, and these are the options open to you as an individual. It is up to you, then, to prepare yourself, and here are your options, but there ought to be enough flexibility, even in that person's decision.

For instance, I have always advocated, and I am not going to get philosophical here, that we ought to be doing both, academic training and vocational, and side-by-side, you ought to be dual-purposed in your education because you have got a wider range of options open to you.

Mr. Choate. And then, to tie it down on these job banks, is so that when jobs are open, to encourage more firms to list, but to set it up where it is interactive and where the worker can go in and find out what is there. I mean, the individual at that point, when they are thinking about retraining, they really do need the information so they can know what the choices are so they are not just, you know, working on hunches and guesses.

I would say something else. Even if the information is not perfect, even if it is only 75 percent perfect, it is better than nothing.

Mr. Skeen. 10 percent.

Mr. Choate. 10 percent even, right.

Mr. Kolberg. Let me talk, if I could, Mr. Skeen——

Mr. Skeen. Oh, yes.

Mr. **Kolberg** [continuing]. Respond for a minute about the job bank again.

The dilemma with the job bank, I think it is a serious one, it goes to the base of our society, really. We have tried to force employers to list their job openings. We have an Executive order on the books that has been there for a decade that says all defense contractors must list all jobs.

Well, you cannot police that. You ask the Labor Department to police that, they are not in the business of being policemen going around forcing defense contractors to list. Unless the contractor really wants to list; unless he sees this as a service that is going to help him do his business, he is not breaking the law, he just does not think this is a very high priority.

Some countries, again, the Western European countries, have laws that say—we heard this from the Swedes—laws that force every employer to list job vacancies.

The reason I go through that is that unless employers list the job vacancies, forget about a job bank because no jobs are going to get in there. The only jobs that are in the job bank now are typically the jobs that most people in this room are not interested in. Jobs in this country are becoming very complicated, professinal, high tech, most of us increasingly, better than half of us, have gone to college, or are going to college, we will not find any of those jobs in the job bank because employers do not list them.

Where do we go to find jobs? That is the dilemma. So let us not get caught up in thinking that somehow it is a mechanical problem. It is not a mechanical problem. The computer capability is there now at the State level, within the State, and between States, to do a good job of running a job bank.

The problem is getting the jobs in there. Once the jobs are in there, boy, you can bet that every job-seeker will go and look. All of us would, if we really thought that jobs we were after were in that job bank and it had a pretty good cross-section of all the jobs available in that community, in that State, and across the country.

That is not the case and it will not be the case unless we somehow can convince, and I would say convince employers not by law, but by saying, "This will help you get your job done. You will get better workers faster if you list your jobs."

Mr. **Skeen**. Thank you very much.

Thank you, Mr. Chairman.

Mr. **Gore**. Congressman Reid.

Mr. **Reid**. Thank you, Mr. Chairman.

Gentlemen, we have listened now for a couple of days to people painting a picture indicating that there is rapid change taking place. There is going to be more change in the future. We have heard a lot of statements about how bad things are, and I am in agreement after having listened these past 2 days.

What I would like to hear from each of you, if possible, is something more specific. What should education be doing? We know we heard some generalities, but specifically, what should education be doing?

Second, what should the Government be doing, and third, what should the private sector be doing? Now, I would, Mr. Kolberg, indicate to you with my knowledge of government and how people react, unless employers are mandated by law to put their names and the jobs in the bank, they are not going to do it. I mean, I do not think.

I would like you to respond to that, also.

Mr. KOLBERG. Well, let me take the last question first. We have tried that and it has not worked very well. I suppose we can hire more policemen to go out and get them to list—to get the defense contractors to list their jobs more effectively. Maybe we ought to do that. I have some doubts as to whether that is going to be very effective. It is going to go the way of a lot of other Federal regulation.

My sense is, in this country, with 10 million separate private employers, that the only way the Government is going to be able to do this is get the mechanism out there and over time convince employers that this will work for them. Then they will list their jobs.

Mr. REID. Mr. Kolberg, just responding to that, that is my problem with the testimony the last couple of days. "Get the mechanism out there." What does that mean? Hire advertising agents to say what a great thing it would be?

Mr. KOLBERG. One thing you have to convince employers of, for instance, is the Government, if you list your jobs, the EEO piece of the Government is not going to come and look at what the employer is doing and use that against him. That is one of the concerns. I think a legitimate concern. Employers are worried. It is the old IRS syndrome; you do not do a lot of things because you are afraid that the IRS will do something to you. It is our problem with tax credits and the whole range of other things in this area. But I think employers, probably some of them have been burned; some of them think they will be burned.

Let me respond to your other questions. Every meeting that we have held in the last 2 years, no matter what the subject, we spend the first hour or two listening to employers gripe about the basic education, the basic literacy that they are getting from people they want to hire out of the public schools.

I do not think the Federal Government has any role in that at all, but we say back, if we say anything at all to employers, it is that it is your own local public school system, go sit on the school board and get busy. My sense is that is happening. But, you know, it is a $100 billion system across the United States. It is owned by you and me at our local level. The only way we are going to change that is not for the Federal Government to pass any laws, but to get an understanding that the basic literacy skills are not being imparted correctly, and that we need to get on with that.

I think the Federal Government, again, has a responsibility to begin to say that, to lead in a thought sense. There is a problem out there, let's do something about it. Clearly, that needs to be done.

Pat and I have been among several from the private sector working with the American Vocational Association and the Department of Education and others to talk about vocational education. We think, although we have not come to any conclusions, that here is an $8.5 billion system out there that really needs to be jerked forward. Very fine facilities, very good teachers, but they need to be brought up to date.

I think the Federal Government has a limited role, again, in providing some resources to the States and localities in vocational education to give that system another spurt into the areas that this committee is examining.

Mr. CHOATE. May I respond?

Mr. REID. Please.

Mr. CHOATE. In my own mind's eye, I break the issue into two separate parts: The first is the K through the 12 system, and the second is the postsecondary system.

On the K through 12, I do not think I can give you any insights that would be useful. On the postsecondary, I think the issue becomes very critical relating to Mr. Gore's opening comment because that is going to be the system that is going to have a heavy responsibility to retrain most of the people we are going to make it or break it with in the economy in the next two decades.

I have a number of very specific recommendations, if I might, just to respond. I think we start off by recognizing that we have a system that is probably composed of about five parts, the training system.

The first is the income-support system, which is the UI system; that system is obviously in great difficulty today for a variety of reasons. There are some things that need to be done there and many of those things that need to be done there, obviously, fall to the State governments to better manage it, tighten it up, take a look at their issues, and in a larger sense, longer term economic recovery will be required before those States are going to be able to really begin to pull down some of the debts that they have there.

The second part is the facilities. On the facilities, the country has built about 4,000 postsecondary institutions that are now in place. As I was indicating earlier, much of the equipment in those facilities very naturally, because of change, is becoming obsolete. It seems to me that we have come to a point now where we need to take a look at how we are going to modernize that equipment at the State and local levels.

I think it is also important to recognize that most of the money to operate those systems are being provided by State and local governments, about 92, 93 percent of the money. There are some things that can be done, the Vocational Education Act is coming up this year, it would seem to me that that could be a very useful vehicle to give States moneys and encouragement to modernize their equipment.

The same is true on faculty and counselors. There is a real need to make sure that the skills of the faculty and the counselors keep pace. Here, again, be it that act or some other act, it can be a very useful investment.

On the question of the information, I think the idea of account executives or industrial coordinators, are people that are in the local vocational and technical schools, makes a lot of sense. I mean, it is not a technologically sophisticated approach, but what it does, it goes to employers and says, what are your needs, and tries to match the training to those needs.

It begins to build the long-term linkages that work very well in agriculture, and I think it will work very well in the industrial community as well. It shows both interest and you establish the kinds of linkages that are necessary.

The final issue is that of financing. As we have indicated on the entry-level training already, most of that financing is provided by State and local governments. That financing has grown even while the Federal financing has declined over the past several years.

The issue becomes one then of how to take money out of the Vocational Act and use that money to help modernize the system and see if perhaps additional money is needed. On the upgrading of training, which is the big core of the challenge, in my own mind's eye, the time has come to give very serious consideration to giving employers tax credits to doing training. I mean, if there is a logic for tax credits for investment in plant and equipment, and if there is a logic for tax credit in technology, there is absolute parallel logic for a tax credit for investment in upgrading the skills of the work force.

Finally, there is the financing on the displaced worker issue. I do not share Bill's opinion, although I respect it, that enough money is being put up for that issue. If we have 2 million displaced workers, if half of them will take training, if we are talking about a $3,000 per training cost on that, we are talking about $3 billion.

What I believe—if one takes a look at the displaced worker programs, you find that there are 22 of those programs now on the books, Federal grant-in-aid programs: The Redwood Act, the Conrail Act, a variety of those.

We need a new mechanism to finance the training for displaced workers, and I think that we can reach back into our experiences in this country, to the GI bill and use that experience, where you have a voucher-base system where the worker can, in effect, go anywhere and take the voucher. I mean, that was the greatest educational and training experience that I think this country, or any other country, has ever had. Then perhaps give consideration to setting up a new third trust fund, this little idea called an individual training account, set up a third trust fund where employers and workers can put in money, be it on an insurance basis, where you just put a small sliver, or fully funded basis, so that the money is there.

What I am suggesting is, I think that the grant-in-aid programs, Federal grant-in-aid programs, even State grant-in-aid programs, are too slow and too cumbersome and they will never be able to raise the type of money to guarantee workers that they are going to have the training that they need.

Those are a few ideas that I would offer.

Mr. REID. Thank you very much.

Mr. GORE. Are you through?

Mr. REID. Yes, I am.

Mr. GORE. Congresswoman Schneider.

Mrs. SCHNEIDER. Thank you.

I am sure, as Congress-watchers, you have observed that the Congress has been making concerted efforts to once again respond, react, put out the fire, as it were, of our current unemployment situation. I think that perhaps you gentlemen, like myself, would prefer to see the legislators here be more creative and progressive in coming up with ideas before we have to do crisis management.

We are now caught in a dilemma where there are numerous pieces of legislation that are being put forward to address the unemployment situation. I think the most controversial, and probably the most talked-about happened to be dealing with protectionism laws and also, as you mentioned earlier, the job bank, which appears to me to be something that is gaining great momentum in Congress as a solution, or as a quick fix, assuming that all of our problems will then be solved if we do go forward with the job bank.

Also, we are looking toward even more public works jobs bills, which quite frankly we do need to rebuild the infrastructure in this country, but when we look at some of the other unemployment needs that exist, particularly among women, we are certainly not addressing the unemployed women by pouring more and more money into public works projects.

So, if I can just summarize what I perceive to be what the two of you are saying is that what we need to do is totally reorient our thinking and to instill in students who are still in a position to approach education with a new frame of reference, that we have to focus on perhaps a renaissance man or woman approach; that we have to look toward multi-skills and that the real emphasis does need to come from the educational sector, not necessarily from Congress. Perhaps we can give some direction, perhaps some additional moneys in certain areas, but that will not be the be-all-and-end-all solution. The real emphasis has to come from the educational institutions.

Second, we need to have a greater reliance, not on government once again, but perhaps on business. We talk about the Job Training Partnership Act. This is an effort, as far as I can see, in bringing the whole Japanese style of management with the labor management and government all together to discuss the solutions to employment.

Now, it seems to me that the Chamber of Commerce can play a major role in providing the initiative. You had mentioned, Mr. Kolberg, your resistance to policing of employers to sign up on a jobs bank. It seems to me that the Chamber of Commerce can do a terrific PR campaign and suggest how this would be an effort to help solve part of the problem.

Are there any other solutions that you see that might rest in our domain for addressing the unemployment problem? I think, Mr. Choate, you were touching on a vague reference, and I do not know if I am interpreting it correctly, but you said incentives need to be made to the private sector to encourage them to do their own training.

Now, as a legislator, perhaps I would translate that into a fact that, well, maybe we need tax credits for employers to do the retraining. We have already given tax depreciation, rapid depreciation for equipment, now we are talking about human capital.

Is this one of your solutions that perhaps we, as a legislative body, could address?

Mr. CHOATE. Yes, ma'am. I would further suggest that it be set up like the R&D tax credit in that it would only apply to that additional expenditure that were made over a three-year historical base. So in effect, that you would be stimulating additional training, rather than substituting public expenditures for private expenditures.

That is, you know, precisely what I am recommending.

Mrs. **Schneider**. Are there some other legislative recommendations that either one of you might make?

Mr. **Kolberg**. I would—I guess I would have to disagree. I am sure Pat would expect me to, on his proposal. I think the business community is very "bearish," correctly so, of a lot of new very expensive Federal initiatives at this period.

I think Pat's idea bears some study over the long term. What I would prefer to have the Congress look at now are some of the proposals that the President has really made, just recently made, in his 1983 Employment Act, to begin to adjust our $23 billion a year unemployment insurance system, to begin to address training.

There is very little training going on under the aegis of the Unemployment Insurance System, and what the President has said is a few very simple and inexpensive things to begin. First of all, to ask the Congress to say to the States, "You are allowed now, under the Federal State system, to spend 2 percent of your unemployment insurance funds for training and retraining and adjusting unemployed workers."

I think it is a very sensible thing. Some States have gone ahead. Again, California, most notably, has gone ahead and done that on their own. Already it is using unemployment insurance funds for that purpose. It seems to me that is a very good idea.

Second, the President is saying, on the extended benefits that are fully federally financed, that the Congress provides and extended for another 6 months very recently, that we ought to consider a job voucher part of that, so that an unemployed individual would have a choice between accepting payments for income maintenance and instead could get that sum put into a job voucher that he could then carry—he or she could then carry to an employer and hopefully get the employer to come along and hire them.

It seems to me now is the time to look at the things that can be done, not massive new tax-base systems, tax credits, huge new systems, but to work on the margin on the things that we have. Frankly, primarily, bank on the private sector to change its practices gradually but surely over time to do a better job.

As I said in my opening remarks, I think the private sector is beginning to handle some of these problems, the problem of dislocation, in a much more effective way than it has in the past. That is the way we respond to problems. It takes a long time. It is a very complicated country. I keep saying over and over, and I know it gets boring to people, that there are 10 million separate private employers. We are not talking about a simple 1,000, Fortune 1000; we are talking about a huge number of separate people who need, through incentives, through laws, through education, to change their practices.

Mrs. **Schneider**. Well, I cannot help but call to mind one of my campaign slogans not too long ago, which was "We cannot wait." I cannot help but think that there are many people who are in a situation where it is easy for us who are employed to say, yes, there is going to be a time now when we are going to have to adjust to the unemployment levels that we are currently seeing. Easy for us to say, but hard for those who are those individuals who are unemployed.

I think that there are a number of progressive businessmen who saw this coming and I think that the leadership, whether it be the National Association of Manufacturers, or your group and other organizations, really are on the spot right now if you are taking a hands-off approach insofar as we are concerned, because the government is taking the position that we ought to stay out of this and let the private sector take its course.

We are all genuinely anxious to see that happen, but we want you to hurry up. So it is not so much that everybody is asking Congress to do something; I would like to be a Congressional Representative saying to business to get moving because if you do not, what we are going to see are the kind of initiatives that are coming forward right now, more and more protectionism pieces of legislation. Our constituents will be screaming, you have not done one thing for jobs, and I cannot say, well, talk to Mr. Trowbridge, he is taking care of all of that, or Mr. so-and-so. We have to make some moves to ease that transition, and I think that Congress would be more willing to take a more moderate approach if we saw business taking the leadership and the initiative there.

Mr. KOLBERG. Well, you have asked us to do that in the Job Training Partnership Act and I think the response from the Chamber and the Roundtable and the CED, our organization, and the Chamber has been good. We are working as hard as we know how to work to get 10,000 separate private-sector business people to join up as volunteers on these private industry councils at the local level to begin to shoulder the training and retraining job, along with the chief elected officials at the State and local level. That is a big job, we are taking it very seriously, and this is not the place to talk to you about what we are doing, but we are not just laying back on the oars.

Mrs. SCHNEIDER. Understood.

Mr. KOLBERG. I think what you ought to say to your constituents, if I may be so bold, is that Congress has been very active in the last 6 months, starting off with that act, the Jobs Act, the dislocated workers, there are a whole range of things.

The only quick fix I know is for the Federal Government to appropriate billions of dollars and create public jobs. I reject that. I think the Congress at this stage rejects that.

If you do reject it, and you are looking for solutions in the private sector, yes, a lot of people are hurting, but it takes time for a large country of this kind to adjust and come around. I think it is, I think it will, I have confidence that it will. I hope that we do not jump to the silver bullet approach, which is always let's hire a lot of people on the public payroll and see if we can figure out something useful for them to do.

Mrs. SCHNEIDER. Right.

Mr. Choate, you wanted to comment, and I do understand that your recommendation for tax incentives is along the R&D tax credit lines. It is a much more moderate scaled-down version.

Mr. CHOATE. That really makes my point. I think that between doing nothing and doing, you know, tens of billions of dollars, that there are a number of moderate things that can be done with adjustments of our existing systems.

It is my view that if one were to talk about an investment tax credit for training, that what one would be talking about would be somewhere in the $2, $3, $4 billion per year tax expenditure, but the important thing about this is you would get a 2-1 or 3-1 or 4-1 match from the private sector. So you would stimulate a great deal more training and it would be, again, like an ounce of prevention here.

If the firm can retrain the worker in the workplace, then the worker stands a better chance of not being displaced. That is one thing.

As to the issue of the adjustments of the trust funds, without getting too far into that, I really do not think that is the way to go. I do not think it is the way to go because we are going to end this year with 35 trust funds that are going to be bankrupt.

If those States, like Michigan and Ohio, have pressure put on them to use their trust funds where they are already, let's say, a billion dollars down; eventually it means that those firms in those States are going to have to pay that money back, and now they are going to have to pay it back with a 10-percent interest as well.

So all of a sudden, it raises the cost of doing business in those States and it makes those States less attractive places to be located in the first place. My point, be it my idea or some of the other ideas, is that in the middle of the depression, when cyclical unemployment was our big challenge, we created a system to deal with that with the UI Trust Fund.

Perhaps now is the time to put a more comprehensive system into place to deal with another change in unemployment: the structural unemployment. If we can do that, we may actually make money or save money off that. If we can speed these workers along in their adjustment and get them back to work, we can perhaps reduce that $23 billion a year that we are having to expend on UI funds, so there may be some real potential and savings here, like putting account executives in the vocational schools.

We are talking about, as Dr. Tuttle tells me, $40,000 or $50,000 per school. That is not a lot of money. You are talking about in a whole State like Oklahoma, $1 million a year. That is cost effective.

Mrs. SCHNEIDER. Thank you very much.

Thank you, Mr. Chairman, that is all the questions I have.

Mr. GORE. Thank you.

Mr. Choate, we heard testimony yesterday about the problems in developing a nationwide computerized job bank. How difficult would it be, in your opinion, to intergrate the existing systems or design a new one, to give jobseekers a current information online about available job opportunities and how much it would cost?

Mr. CHOATE. Technologically, I do not think it would be any great difficulty at all. I have talked with various computer specialists in TRW and other companies. That has advanced significantly. As to the cost of that, I would not have precise information, but I cannot see where you are talking about more than $30 million, $40 million a year at the outside.

Mr. GORE. $30 million or $40 million.

Mr. CHOATE. It depends on how you go, how you use the equipment that you have got, whether you lease, whether you buy, I mean, it is the whole range.

Mr. GORE. But you have actually spent a little time looking at this to see in a general way whether or not it is practical——

Mr. CHOATE. Technologically——

Mr. GORE. Yes.

Mr. CHOATE. It is possible.

Mr. GORE. It can be done?

Mr. CHOATE. Yes.

Mr. GORE. And the cost would not be—probably not be outside the range that you are talking about.

Mr. CHOATE. Well, the issue, I think, that you are faced with is one of saying, we have workers, they are under UI. We are paying UI. We are paying UI. We are paying, let's say, the $23 billion a year.

The question is, how can you speed it along? I mean, each day that you can speed it along, you are actually saving money. So it becomes—whatever the cost is, balanced against that benefit/cost ratio, and you are playing against such big numbers here that even if the costs go up substantially higher, it makes sense.

Mr. GORE. Yes.

Mr. CHOATE. From just the money sense, from the money standpoint.

Mr. GORE. Now, with respect to forecasting, what do you consider lacking in our current methods for projecting future jobs? We heard yesterday that it is difficult to forecast jobs with any accuracy. Do you agree or disagree?

Mr. CHOATE. I think that BLS does a very good job. I think that the information that they provide is useful and it is useful from a policy sense. My special pleading to the committee would be to find ways to provide moneys to the State and local governments to do the short-term projections, to do the immediate job identifications to help the State administrators and the local administrators identify with specific employers what their specific needs are so that they can link their training to that. I think that is where our real gap is.

Mr. GORE. What do you think is that critical connection between quick-start training programs and reliable information?

Mr. CHOATE. I think Dr. Tuttle can answer that better than I, but I think the critical point there, at least as I have seen it, is that the training system asks the employer specifically what they need, and then works with them very precisely to put that in place.

Incidentally, there are 30 States now that are using quick start, so it is not a hybrid in one or two States. I mean, we really do have some trainers out in State governments that are really doing some good advances. There are some good solid bases to build on here.

Mr. GORE. Well, now, you say that the linkage between those programs, or between public programs and private training programs in institutions, is a confused linkage. Could you give examples of what you mean by that?

Mr. CHOATE. Well, in the testimony, for example, I went back to a GAO study of Tidewater, Va., where there was this great array of agencies, public and private, that were engaged in the training programs and the GAO concluded in their study that there was limited linkages between employers.

Again, it comes back to the question of these hearings. What is the available short-term information that is there? When one takes a look, you see in too many instances, or most instances, it is just simply not there. That is causing the confusion, both in the administrative structure and in just simply the information.

Mr. GORE. Now help me develop a better understanding of your specific recommendation for funding this voucher system that you talk about.

Mr. CHOATE. OK.

Mr. GORE. You have—first of all on the voucher part of it, what you are recommending is that people who are seeking job retraining be given a voucher that is spendable or usable at the job retraining program of that worker's choice so as to rely on the intuition and intelligence of the people who are seeking out retraining in the hope, and I would say assurance, that they are likely to make better choices than someone trying to design a program from the top down would make as to what occupations are going to be most in demand.

Now, in order to pay for those vouchers, you are suggesting a new trust fund that employers and employees would pay into, just another part of the FICA tax; right?

Mr. CHOATE. It could be attached to that or set independently, but it would be a third trust fund; the principal is the same.

Mr. GORE. Do you have any levels in mind?

Mr. CHOATE. Well, there are several ways that this could—I think it is important to distinguish the voucher from the financing. The voucher could be financed by straight Federal grants; it could be financed, you know, in many different ways. But it would work the same way, like the GI bill. In order words, an individual could go to a public institution or private institution to do the training.

As to the issue of raising the money, there are several ways. One way would be to do it as an insurance approach. Under an insurance approach, you would have a very limited amount of money. You would probably be talking about $3 billion to $6 billion per year, raising it from employers, which is at this point about 15 percent of what is being paid in UI, so it is not that much of an additional burden on employers.

So that would be one way; just run it like a straight insurance scheme. Another way to do it would be to run it like a fully funded system, and that would be employers and workers at some level, like three-fourths percent of their gross wages on a matching basis, would contribute and build it up to some amount like $2,000 of contribution each over a 7- or 8-year period. Then, like an IRA, they would quit paying. At the time that they need it, they would have the money; and at the time that they would retire, they could draw back their money.

A third way would be to do it like a whole life insurance where you string it out a little bit longer where you have some insurance, and then where you build it up, and when you build it up to your $2,000 contribution, you quit paying.

But, you know, the important thing here is to have a system or a fund that has integrity that is assured and where the worker is absolutely assured that they can get retraining.

It is my own view again that if workers have that feeling, we can really reduce a lot of the problems that Congresswoman Schneider was mentioning, these demands for protectionism if workers can know that they can keep pace. But they have got to have that assurance. I think the third trust fund is a way to do that.

Mr. GORE. Now your proposal for the individual training account, you see as just another option?

Mr. CHOATE. This is it, the voucher of the GI bill, the individual training account. They are all the same thing; just different ways of describing it.

Mr. GORE. I see. All right, fine.

Mr. Kolberg, who bears the responsibility for retraining? You just came from this conference that you have described. There was a lot of commotion there as reported in the newspapers this morning. Does that have anything to do with the feeling about who has the responsibility for retraining workers or do you think that it has——

Mr. KOLBERG. I think that it has some, Mr. Chairman. I think the President recognized it in his speech. The anger that the steelworkers feel now is very understandable. I think the culture has been saying to a lot of us that once you work hard, you get good training, you locate with a good company, that you are pretty well set if you work hard. It is the work ethic in our society. These people have done that, and all of a sudden, they are out. So they are angry and they are in the process of trying to figure out where do we go from here.

Clearly, retraining is one of those options. It takes a while for a number of individuals to get to the point of seeing that life has changed and they have to get retraining.

Now, you ask who is responsible for that? I think we are gradually changing our answers to some degree. In the past, one would say, well, the individual is responsible for that. I suppose that would have been the typical answer. I think we are gradually changing that.

The Ford Motor Co. is now saying, we are, along with UAW, we are going to change that. Five cents an hour is going to go into a retraining fund and we in the union agree that we have a joint responsibility to take care of people who are going to be laid off, and provide retraining and a whole lot of others.

How far that movement will go in the private sector, I do not know. My sense is that it is going to go a long way, that typically at least the larger companies are going to come along and do a number of those things, so retraining will then become a part of an employer responsibility for his current employees.

Certainly the Federal Government is shouldering a part of that. Under CETA, under the Job Training Partnership Act, yes, there are funds. The new money under title III for dislocated workers. Clearly, State and local governments, through vocational education programs, typically have a share of that responsibility as well.

I suppose when you get all through with that, however, the basic responsibility for all of us in a society of this kind rests with each of us. If you have the resources and the know-how to go get retrained, it is your responsibility to do that. Look around for help if you need it, and hopefully there will be help from the various private and public parties, but for most individuals, I think that is going to continue to be an individual responsibility.

Mr. Gore. Do you think that business has a responsibility to notify workers who are going to be laid off as far in advance as they possibly can?

Mr. Kolberg. I think business has that responsibility. On the contrary, I do not believe that the Federal Government—and I would be very much opposed to the Federal Government passing a law forcing all employers to pre-notify. I think that is using a very large sledgehammer that may or may not be useful. Some States, I believe three States now have passed prenotification laws. Some cities are getting into that business.

I think our hope in the private sector, and one of the reasons for this conference, is to see if we cannot urge businesses along so that, in fact, this becomes good business practice.

I was encouraged with what the Roundtable is doing, what the NAM is doing, saying to their members, this is a responsibility of employers. The only way we can really treat workers correctly, give them time to adjust, work with them, provide the retraining and all the other services, is if we have some warning.

So, yes, I think it is a responsibility of the private employer to provide adequate warning, recognizing at the same time, and it came out over and over in these panels—the gentleman from AMEX talked about it—sometimes there is no warning. A contract that an employer had counted on, whether it is a defense contract or whatever, falls out. You do not know that is going to happen, and when it happens—and he used a very pronounced situation with an aircraft company that he worked for at one stage, where he was told in the space of 10 days to lay off 5,000 workers. That aircraft company had counted on a contract that did not come through. Without that contract, there was no way that those plants could keep going, so I think we need to recognize that in an economy of this kind, there are those kinds of things. But good practice clearly requires that employers give as much warning as they possibly can.

Mr. Gore. I welcome that response, but we heard yesterday from the 9-to-5 organization, for example, that notice was customarily quite short. We heard testimony that the recent layoffs at Atari involved one day's notice to the first 800 employees laid off.

It seems to me that there are economic pressures that encourage businesses to delay notification until the last minute because workers who have a great deal of notice are going to be out looking for other opportunities, as they should be, and it is only fair that they should have that opportunity, but do you really believe that in the face of those economic pressures and in light of the evidence that has been presented here that there is any real hope that voluntary urgings from the National Alliance of Business is going to change the current practice of very short-term notification?

Mr. Kolberg. I do. I think there will be. I think we are gradually but surely changing the labor/management culture in our society.

Whether we get to the stage where the Japanese have gotten, who knows?

I think there will always be those instances where employers either do not know or the labor/management situation is so unfortunate in a plant or in an industry where it just does not work.

As I think you have heard me say several times this morning, I am very wary, and in most instances, skeptical of grand national solutions to very difficult problems involving 120 million workers and 10 million separate employers.

I think it would be a mistake in this country to pass a pre-notification law covering all workers and specifying all industries and specifying a precise number.

Mr. **Gore**. I am not laying the groundwork for such a proposal——

Mr. **Kolberg**. I understand you are not, but——

Mr. **Gore** [continuing]. But I am, I guess, equally skeptical of the viability of a solution based on just appeals to the better nature of folks who have an economic incentive to do the opposite.

But I hope you are right; I mean, I hope that——

Mr. **Kolberg**. I hope I am right, too.

Mr. **Gore**. I think there is a profound change in the culture of labor/management relations, as you put it, and that change is really a profound one.

Mr. **Kolberg**. I hope that Congress gives the employer community a chance. You know, typically in a situation of this kind, employer organizations say to their members, this is good practice and it is equity in its fairness.

Now, let's behave that way. If we do not behave that way, since it is so clearly equity in good practice, at some stage, society will step in and set new rules for business.

Mr. **Gore**. Yes.

Mr. **Kolberg**. That is essentially what employer organizations are now saying, that this is a very serious problem and that we need some good practice in the employer community. Here is what good practice is, let's go do it, because if we do not, society will set the rules for us.

Mr. **Gore**. Yes. So according to that model, it would be useful for such noises to be made periodically in the Congress to strengthen your arguments.

Mr. **Kolberg**. My sense is, Mr. Chairman, those noises get made quite often.

Mr. **Gore**. Yes. You mentioned the change in Japan. I noticed a newspaper article in the New York Times recently—you may have seen it—about the company that was installing robots more rapidly than they had anticipated several years ago. They proposed—reached an agreement with the union to pay—for the company to pay union dues for each robot.

Mr. **Kolberg**. I saw that.

Mr. **Gore**. Both the business and the union agreed to that arrangement, but the relevant Department of the Japanese Government declared that to be against their national policy and the arrangement was denied.

Mr. Volkmer.

Mr. **Volkmer**. No questions, Mr. Chairman.

Mr. GORE. Well, let me thank you both for appearing here today and for helping us in this effort. We appreciate it very much.

Mr. CHOATE. Thank you.

Mr. KOLBERG. Thank you, Mr. Chairman.

Mr. GORE. Our next witness is Joyce Kaiser, Associate Assistant Secretary of the Employment and Training Administration with the Department of Labor; accompanied by Burt S. Barnow, Director of the Office of Research and Evaluation.

Welcome. We are delighted to have you here. Without objection, the written text of your prepared statement will be put into the record at this point and we will invite you to proceed with your presentation.

STATEMENT OF JOYCE KAISER, ASSOCIATE ASSISTANT SECRETARY, EMPLOYMENT AND TRAINING ADMINISTRATION, DEPARTMENT OF LABOR, ACCOMPANIED BY BURT S. BARNOW, DIRECTOR, OFFICE OF RESEARCH AND EVALUATION, DEPARTMENT OF LABOR

Ms. KAISER. Thank you, Mr. Chairman, members.

Much of the material that is in my prepared statement has already been covered by Mr. Kolberg and I thank him for that.

The problem of the dislocated worker is clearly not a new one. The ultimate dislocation of scientists and engineers in 1970 was a result of overtraining, a reaction to the Russian space shot which took us all by surprise in 1957.

We have that kind of change occuring now and I anticipate that we will be having the same kinds of responses to current problems that may turn out to be our future problems.

Even with economic recovery, we do not anticipate that the problem of structural dislocation will be solved. It is very unclear as to the magnitude of the problem now and we are finding, even in some of our programs, that what we believe to be structural dislocation has, in fact, turned out to be cyclical dislocation.

The administration has had basic programs for the past 50 years to deal with unemployed workers, the Unemployment Insurance System, extended benefits, Federal Supplemental Benefits, and the Employment Service.

As Bill Kolberg mentioned, the Employment Act of 1983 are the proposals we have endorsed and which are currently being taken under advisement by the Congress. Those proposals are in addition to the basic structure. Extending UI benefits through the Federal supplemental compensation program has already been enacted. A voucher program, is being looked at. In lieu of receiving benefits unemployed workers could, in fact, go to employers and use half of their weekly compensation to defer UI taxes paid by the employer. This would mean that their period of eligibility would be extended until their total award ws depleted.

We are also asking to have States be allowed to use part of their UI tax receipts to provide training and relocation assistance. I know that there is some concern about that because of the solvency issue, however, having that authority on the books, when the trust fund becomes more solvent will enable States to take on that training activity.

We are also encouraging States to use their UI system to facilitate reduced work hours as an alternative to layoff that is, happening in California, Oregon, and I believe Arizona.

I think it is important for us to talk about title III of the Job Training Partnership Act. We anticipate that we will be able to serve 100,000 workers in 1984 with the President's request of over $200 million.

Currently, we have out in the States 75 percent of $110 million, and programs are now beginning to start.

Experience in this arena has not been vast. As I said before, we have had dislocation. We have had the MDTA programs, we have had other emphasis on dislocation.

The most recent experience has been in the Downriver Community Conference. That program was established in July 1980 in southeastern Michigan to respond to plant closings. The final results of that activity are not in, although we do have an extensive evaluation component attached to the downriver project.

It does seem, though, through findings of the first phase, that we have a number of dislocated workers who are willing and able to take advantage of retraining and that, in fact, the retraining effort does provide them with an opportunity to go back to work.

Seventy-two percent of the workers were reemployed after receiving services at an average per hour wage of $8. Downriver was a phased-in program and so there is more to learn.

In late fall of 1982, we also established six additional demonstration sites through the Department of Labor to try alternative ways of dealing with the dislocated worker problems. Those sites are in Lehigh Valley, Pa; Alameda County, California; Yakima County, Washington; Buffalo, N.Y.; Willamette Valley, Oregon; and Milwaukee, Wis.

The California project in Alameda has a unique feature in that General Motors is also there. It also has the United Auto Workers and the State of California as participants.

In Yakima, the project is administered by a private firm. Milwaukee is using job-matching linked with on-the-job training contracts.

We are very hopeful, I would be foolish to say that we are sure, but we are very hopeful that these efforts are going to provide us with models to be replicated throughout the country in order that the money that we are requesting in 1984 is well utilized.

In addition, we recognize that we do not know enough about the problems of future technologies, so that in 1982 and early 1983, we commissioned a number of research projects. The Center for Naval Analysis is carrying out a study to determine if the need for reallocating labor due to technological change can be met by existing skills of workers, or whether we really do have a need to have these workers acquire new skills.

Carnegie-Mellon University is analyzing the extents to which robots can be substituted for human labor and the impact on jobs. We talk about it, but I am not sure anybody really knows what the significance of that change is.

Mr. Gore. Excuse me, Ms. Kaiser. You are spending how much money for that first study?

Ms. Kaiser. Dr. Barnow.

Mr. **Barnow**. Which one was that?

Ms. **Kaiser**. The Center.

Mr. **Gore**. To find out whether or not we might need new skills in the American work force.

Mr. **Barnow**. I do not have the exact figure. I believe it was under $200,000. They were taking UI records, Unemployment Insurance records, in about three States, not in the country as a whole.

Mr. **Gore**. Do you have any doubt as to what the answer is going to be?

Ms. **Kaiser**. There is always doubt.

Mr. **Gore**. You doubt that there is likely to be a need for new skills in the American work force?

Ms. **Kaiser**. No, sir. I think the issue is as to whether we can take the existing skills and build on them, or whether we need to actually retool people from the very beginning. The issue is transferability of skills from one job to another.

Mr. **Barnow**. May I add?

Ms. **Kaiser**. Sure.

Mr. **Barnow**. They are looking at several types of industries, both industries that are declining and industries that are growing, both of which are undergoing technological change. Then finding out what happens in each of these cases.

Do the workers seem to stay in the industries, getting retraining, or are the old workers let go and new workers brought in with different skills? I think that is the emphasis of that study.

Mr. **Gore**. Well, I will not interrupt you further except to say that I think I could have saved you $200,000 there, because the consensus among the experts in this field is that the answer to that question is pretty obvious; that there is going to be a massive need for retraining American workers and giving them brand new skills.

Go ahead, we will come back to it.

Ms. **Kaiser**. Thank you.

We are also supporting some other studies on productivity. As a matter of fact, it was appropriate for you to interrupt because that concludes my remarks and I will be happy to try to answer any questions that you have.

[The prepared statement of Ms. Kaiser follows:]

ST09705/C-1

STATEMENT OF JOYCE KAISER
ASSOCIATE ASSISTANT SECRETARY OF LABOR
FOR EMPLOYMENT AND TRAINING
BEFORE THE
SUBCOMMITTEE ON INVESTIGATIONS AND OVERSIGHT
COMMITTEE ON SCIENCE AND TECHNOLOGY
U.S. HOUSE OF REPRESENTATIVES

April 7, 1983

Mr. Chairman and Members of the Subcommittee:

I am very pleased to have the opportunity to review for you today, the Employment and Training Administration's experience with programs for retraining displaced workers and the initiatives we are taking under the Job Training Partnership Act to assist this group of unemployed workers.

The phenomenon of displaced workers is not a new one, but during the last years it has increasingly been recognized as a serious problem that we will have to contend with at least for the remainder of this decade and perhaps for the remainder of this century and beyond. The problem relates to experienced workers who have been permanently or indefinitely laid off due to structural changes in the economy. These changes -- resulting from foreign competition, obsolete plant and equipment, outmoded methods of production, changed consumer preferences, and the like -- have caused historically high levels of unemployment in particular industries, and there is the likelihood that even with economic recovery, a significant number of these unemployed workers will not be rehired in their original industries and occupations.

The Administration has assigned this aspect of the unemployment problem particular priority. In his State of the Union Address, the President noted that "No domestic challenge is more crucial than providing stable, permanent jobs for al Americans who want to work. The recovery will provide jobs for most, but others will need special help and training for the new skills." And in his budget message to the Congress, the President emphasized that "those whose jobs have permanently disappeared must be helped to find new long-term occupations."

In response to the specific concerns of the Subcommittee that were raised in your letter of invitation, I would like, first, to outline some of the major steps the Administration is taking to attack this problem and, then turn to some of our earlier program experience in dealing with this problem. I will also briefly note several research and demonstration projects being conducted by the Employment and Training Administration, which may be of interest to this Subcommittee.

Currently, Title III of the recently-enacted Job Training Partnership Act and the Unemployment Insurance and Employment Service programs are the principal resources available to ETA that are directed to the dislocated worker program. I will return to JTPA in a moment.

The Unemployment Insurance system provides dislocated workers with income support, at least for the initial period following layoff. Extended and supplemental benefits may provide compensation beyond the initial period of eligibility. The Employment Service provides job search and placement assistance to those dislocated workers who apply for these services. Special assistance programs have also helped specific categories of displaced workers -- the largest of these programs being Trade Adjustment Assistance.

In addition, the Administration's proposed "Employment Act of 1983" would provide a series of initiatives to help the long-term unemployed by:

- extending the Federal Supplemental Unemployment Compensation program through September 1983 -- this already has been enacted into law;
- allowing workers to receive job vouchers in lieu of direct benefits;
- allowing States to use a reasonable portion of their UI tax receipts to provide training and relocation assistance; and
- encouraging States to adapt their UI system to facilitate reduced work hours as an alternative to layoff.

Title III of JTPA is the major program of the Department that is exclusively focused on the dislocated worker problem. The Job Training Partnership Act is landmark legislation for a number of reasons -- it gives the business community a statutory role in the planning, administration and oversight of employment and training programs; it focuses program resources overwhelmingly on training, rather than participant wages and allowances and administrative overhead; and it is built upon a new partnership between the State and local governments and the business community, with a minimum of Federal intrusion. JTPA also reflects a basic departure from past employment and training programs in that it recognizes a specific responsibility for assisting experienced workers who have been permanently laid off.

Under the Title III program which is just now getting underway, States, with the assistance of private industry councils, will identify groups of dislocated workers and determine what job opportunities exist for which the individuals can be trained. Funds provided to the States may be used to provide job search assistance, job development, training, pre-layoff assistance, relocation assistance, and joint employer-labor programs of early intervention in the event of a plant closing. There is a State matching fund requirement for the program, but the State match is reduced for States with particularly high rates of unemployment.

A total of $110 million has been appropriated for the Title III program for FY 1983, with $85 million of this coming from the jobs bill that was enacted two weeks ago. The President has requested more than twice this amount in the FY 1984 budget for Title III. These funds will enable nearly 100,000 participants to be served in FY 1984.

To some extent, the JTPA Title III program has been and will continue to be shaped by our experience in serving dislocated workers under the Comprehensive Employment and Training Act. While CETA programs focused almost exclusively on the disadvantaged population, a series of demonstration projects was funded under CETA to develop models for serving dislocated workers. The first and best known of these still ongoing projects is the Downriver, Michgan project, located near Detroit. I would like to take a few moments to describe these projects and some of the early findings of our assessment of this experience.

The Downriver project was established in July 1980 under the sponsorship of the Downriver Community Conference. It was undertaken as a response to a number of major plant closings that occurred in the Southeastern Michigan communities that make up the conference.

The project was designed to provide a wide range of assistance to workers permanently laid off from selected plants in the area. This assistance includes classroom and on-the-job training, relocation services and job search assistance. The project is being carefully monitored and has attached to it an extensive evaluation component to document the effectiveness of retraining in general and to assess specific approaches. To measure the impact of the program, the evaluation provides for comparing the post-program earnings and employment experience of program participants with the experience of a group of workers in similar circumstances but not receiving services.

This project is still underway and the evaluation study is not complete, but evidence from the first phase of the project is encouraging. A high proportion of workers from the eligible plants elected to particpate in the program. Of those participanting, 57 percent received some training. The experience to date suggests that displaced workers will take advantage of adjustment services when they are made available." There are, however, significant differences in the participation rates among demographic groups. Thus, younger and better educated workers appear more likely to take advantage of this type of assistance.

The evidence on outcomes as a result of the services provided to participants in the Downriver project is incomplete, but preliminary results also are encouraging. Thus, 7? percent of those workers served in the first phase of the project were re-employed at an average wage of $8.00 per hour. These figures are significantly better than for the comparison group that did not receive such services.

As further data becomes available, the Downriver project is expected to yield findings with respect to the relative effectiveness of alternative services in re-employing displaced workers, the effects of dislocated worker programs on unemployment duration and earnings loss, and the best techniques for matching displaced workers with local demand for labor.

Downriver, of course, reflects the experience of only one geographic area and a particular set of circumstances. To broaden our insignts and test other approaches, we have undertaken dislocated worker projects in six additional communities.1/ Although the six demonstrations are addressing the same problem of worker dislocation, they vary in emphasis and design, as well as sponsorship. For example, the U.S. Department of Labor is participating in a project in Alameda, California with the State of California, the General Motors Corporation, and the United Auto Workers. A Yakima, Washington program, on the other hand, is being administered by a private sector firm.

The demonstration sties also vary in the relative emphasis on particular types of services and the level of training provided. Most of the sites offer a mixture of classroom and on-the-job training supported by job development efforts, but each site tends to assign its own priorities among approaches. For example, Milwaukee is relying primarily on a job matching program linked to OJT contracts. Other innovative approaches being tested include obtaining pretraining commitments from employers for graduates of training courses (in Alameda), and performance based contracting (in Buffalo).

1/ Demonstration projects are located in: Lehigh Valley, Pa.; Alameda County, Calif.; Yakima County, Wash., Buffalo, New York; Willamette Valley, Ore.; and Milwaukee, Wisc.

A key issue in dealing with dislocated workers is whether those who are displaced can be retrained for jobs that are being created in new and emerging technologies and industries. Frequently, there are large differences between the education and skill levels which were appropriate for the old technologies and those needed for work in new fields such as robotics, microcomputer technology, and computer assisted drafting. A number of our demonstration training sites have placed some emphasis on high technology occupations, and we look for future evaluation studies to give us some insights into this problem.

We have underway a number of research projects looking at various aspects of the broad issue of technology and its impact on the labor force. For example, the Center of Navel Analysis[2/] is carrying out a study to determine if the need for reallocating labor due to technological change can be met by the existing skills of workers, or whether it requires substantial new skills. A major focus of the study is the adjustment to technological change in the steel and auto industries.

Another study, by Carnegie-Mellon University,[3/] is analyzing the extent to which robots can be substituted for human labor.

[2/] Impact of New Technology and the Implications for the Labor Force; Center for Naval Analysis; study in progress for the Employment and Training Administration.

[3/] A Methodology to Predict the Substitutability of Robots for Factory Workers Based on a Dexterity Measure; Carnegie-Mellon University; study in progress for the Employment and Training Administration.

The study is attempting to develop a method for forecasting job losses as the use of robots becomes more common. Other studies are looking at the implications of specific technological developments such as office automation and the computerization of the newspaper industry. We also are supporting a number of studies of productivity that will provide additional insights into how firms adjust to changing skill requirements.

Mr. Chairman, this concludes my review of the Employment and Training Administration's current efforts to assist dislocated workers. At this time I and my colleagues will be pleased to answer any questions that you and other Committee members may have.

Mr. GORE. All right. That is fine, I wish I had waited another——

Ms. KAISER. Two seconds.

Mr. GORE [continuing]. Ten seconds, then.

You do not seem to think that there is much of a problem with workers being displaced by automation or new technology; is that correct?

Ms. KAISER. No, I do not think that is quite correct. I think that we have not taken an adequate look at the skills transference. For example, in the secretarial field, we have word processors. Now, the secretarial skills are still there, they need to be there, what needs to happen is to have the evolutionary process occur so that that secretary can make use of existing skills and then work into new occupations.

It is not clear that without that basic skill, that this individual will be able to find a job. So we are talking really much more about building on existing skills wherever possible.

Automation may not be as scary as it is made out to be. It is quite conceivable the number of individuals with basic skills can be, with some retraining, and not necessarily a lot, be retooled and be able to go into other jobs.

Mr. GORE. Ms. Kaiser, every witness we have had here during these 2 days has agreed with the statement that the United States of America is undergoing right now, and in the balance of this century, the most dramatic and revolutionary transformation in its economic base and its work force that has ever occurred in history. Do you agree with that?

Ms. KAISER. Yes, sir.

Mr. GORE. You do?

Ms. KAISER. Yes, sir.

Mr. GORE. Do you further agree that there will be an unprecedented number of Americans losing their jobs and having to acquire new skills in order to gain employment in the new jobs that are likely to be created?

Ms. KAISER. Yes, sir.

Mr. GORE. Well, then, why would we want to have a study to see whether or not the answer to that question is yes?

Ms. KAISER. Well, it is not—the study's focus is not whether the answer is yes; the focus will be to determine to what extent we can build on the skills that exist, and that they are transferable to these new occupations.

Mr. GORE. How much of your effort to solve the problems of structural unemployment is directed at the effects of automation and technology now? Are you waiting for the results of this study?

Ms. KAISER. No. In fact, the Department of Labor has many functions that it performs. Our main thrust under title III is to provide training. Although we, in fact, fund the training, the responsibility for the design of that training is in the State and at the local level, so that studies and research that is done is done as an adjunct to our other functions, but we are really moving ahead in training workers through States and local communities.

Mr. GORE. Is there Federal oversight of——

Ms. KAISER. Yes, sir, it is our responsibility to make sure that the expenditures of funds are done in accordance with the law. We will be looking at discretionary requests. There is a provision under title III that 25 percent of the available funds are under secretarial discretion, so we will look at the programs that States submit for discretionary funding.

In terms of the 75-percent money, it is at the Governor's discretion how that money is expended on training.

Mr. GORE. Well, now, you make it sound a little like there is no direct Federal role, that it is a State responsibility. Is that a misimpression that I am getting?

Ms. KAISER. No, sir, that is not. It is, in fact, our feeling that it is wiser and better utilization of funds to have local control over the design of training programs and also, in the area of title III, to have the Governor have the opportunity to put those funds in areas in his State where they are most needed.

Mr. GORE. Well, if we are, in fact, in a period of revolutionary change, without any precedent in history, and if we do, in fact, need as a Nation to retrain millions of American workers over the next couple of decades, do you not think it might be appropriate to have a nationally coherent program to get that effort underway?

Ms. KAISER. I joined the Employment and Training System in 1965 in the State of California. At that time, I worked in the Employment Service. I also worked in a variety of other areas where there were lots of Federal regulations and lots of information put out about how to run programs.

It was never very clear to me then, and I am absolutely sure of it now, that the Federal Government is in a position to dictate local programs. They are just not close enough to the activities, the business community and the locality. The local elected officials, and to some degree, the government, can get together and assess the needs of that community, assess the needs of the worker far better than someone in Washington.

Mr. GORE. So your answer is that you do not think we should have a nationally coherent program to address this problem.

Ms. **Kaiser**. Well, the coherency of the program, is not the issue. I think that you cannot have a national design. There is not one single thing that is going to work everywhere in this country.

Mr. **Gore**. Now, one——

Mr. **Volkmer**. Would the chairman yield?

Mr. **Gore**. Yes, be glad to yield.

Mr. **Volkmer**. But is it not also possible that where programs have worked in certain areas, that the Federal Government could use these as guidelines to follow without dictating specifics?

Ms. **Kaiser**. Yes, sir, and that is what prompted us to put together those six demonstration sites and also the Downriver Experience so that we would be able to share with States models that were, in fact, effective in other States.

However, the issue is that it is not fair to say to a particular locality that this model is the one. What we are attempting to do is to provide enough different kinds of models that States can adapt to their own use.

Mr. **Volkmer**. There is some Federal effort, then?

Ms. **Kaiser**. Oh, yes, sir.

Mr. **Volkmer**. Thank you, Mr. Chairman.

Mr. **Gore**. Now one thing that you are directed by law to do, and we had conversation about this yesterday, and I am sure you expect this question——

Ms. **Kaiser**. First thing this morning.

Mr. **Gore**. One of the things that you are directed to do, under the law, is to establish a nationwide computerized job bank. Your department was directed to do that 3 years ago. It is directed to do it again in the Job Training Partnership Act.

Why have you not done it?

Ms. **Kaiser**. We have job bank existing in 41 States; job matching exists in 21 areas. We have automated applicant data system in 38 States, and, in fact, are in the process of trying to improve our interstate clearance system.

I just attended three sessions with State representatives in San Francisco, Washington, and Chicago to talk about the problems of the interstate clearance system as it existed. The solution to that problem is not, as Mr. Kolberg indicated, it is not the existence of the mechanism; it is the willingness of the employers to put the jobs in the job bank.

In fact, some areas have found that the job bank is more of a technical headache and not worth the effort to maintain it. The utilization of the job bank, if there are not massive amounts of data, is wasteful. We need to win our employers back, and then make some effort to insure that they get the kind of service that we promised them.

Our interstate clearance system, in my assessment up until now and until we planned for some changes, has not been an effective mechanism at all and it was nothing that we actually go out and sell to the employers.

Mr. **Gore**. It is not computerized; is it?

Ms. **Kaiser**. It was computerized insofar as Albany was concerned. In other words, you would send job orders in, you would send applications in and a match kind of activity would take place.

Mr. **Gore**. The interstate clearing system involves taking photographs of the files and mailing them through the mail from one State to the other.

Ms. **Kaiser**. Right. It was inefficient and ineffective, and now we anticipate doing it through data tape systems.

Mr. **Gore**. Let me ask you my question——

Ms. **Kaiser**. The State systems are not all compatible.

Mr. **Gore**. Let me ask you my question again. Why have you not created a nationwide computerized job bank?

Ms. **Kaiser**. I guess what I attempted to say was that if we have a job bank system in 41 States, that we have made an attempt to do that. What the problem has been is that the States have had some latitude on the kinds of equipment that they could buy.

Mr. **Gore**. Each State system is different; right?

Ms. **Kaiser**. That is right.

Mr. **Gore**. You have got 40—now wait a minute now.

Ms. **Kaiser**. OK, I understand where you are going.

Mr. **Gore**. You have got two things here. You have got a nationwide computerized job bank, which you have been ordered to establish by a United States law passed by the Congress, signed by the President, and in effect.

On the other side, you have got 41 completely different State systems that are uncoordinated and unconnected. Now, I am asking you why you have not done this, and you are telling me we have done this.

Ms. **Kaiser**. All right. The——

Mr. **Gore**. Why have you not done this?

Ms. **Kaiser**. What we are trying to do now is to take those systems and make them compatible in the best way we can, given the resources that we have. That is, to improve that clearinghouse mechanism by allowing the State to use what systems they have to provide to our Albany center and providing back to them in a format that they can use in order to have this clearinghouse.

Mr. **Gore**. Do you plan in the foreseeable future to comply with the law?

Ms. **Kaiser**. Yes, sir. To the extent that we can. I can provide you with a description of that system, and then——

Mr. **Gore**. I do not—the 41 separate States?

Ms. **Kaiser**. No, sir, the plan that we have for making their systems compatible for a national system.

Mr. **Gore**. When do you think that will be done?

Ms. **Kaiser**. Probably in the early part of the next fiscal year. Getting all the pieces in place so that it can operate.

Mr. **Gore**. In October of this year.

Ms. **Kaiser**. Yes, sometime in the first quarter, hopefully.

Mr. **Gore**. So you think before the end of this calendar year, we will have a nationwide computerized job bank?

Ms. **Kaiser**. We will have—that is potentially possible. That is what we are trying for.

Mr. **Gore**. Do you think it will happen?

Ms. **Kaiser**. Yes.

Mr. **Gore**. OK. And you have a plan to accomplish that?

Ms. **Kaiser**. Yes, sir.

Mr. **Gore**. Your assistant appears to be a little nervous with that response. [Laughter.]

Is that to be interpreted as a discounting of your pledge to the subcommittee?

Ms. **Kaiser**. He is cautious. He is much more cautious than I am.

Mr. **Gore**. More cautious. I see.

Now in the meantime, this is what we have to substitute for the nationwide computerized job bank.

Ms. **Kaiser**. No, I actually think what we have to substitute for the nationwide job bank is probably not as good as that.

Mr. **Gore**. OK.

Well, you understand that it is a little frustrating if the Congress passes a law and directs the Department to do it and it just does not get done. That is frustrating. And then we have witnesses who come here and say that it can be done, there is no technical reason why it cannot be, it should be.

We will revisit the issue in the first quarter of the next fiscal year and hopefully we will look forward to having you and Mr. Barnow here to describe——

Ms. **Kaiser**. See who is right.

Mr. **Gore** [continuing]. The functioning of the——

Ms. **Kaiser**. May I say one other thing?

Mr. **Gore**. Do you have a plan to accomplish that?

Ms. **Kaiser**. Yes, sir.

Mr. **Gore**. Could you supply that to the subcommittee?

Ms. **Kaiser**. Right.

Mr. **Gore**. Thank you.

[The information follows:]

[illegible]

U.S. HOUSE OF REPRESENTATIVES
COMMITTEE ON SCIENCE AND TECHNOLOGY
SUITE 2321 RAYBURN HOUSE OFFICE BUILDING
WASHINGTON, D.C. 20515
(202) 225-6371

[illegible]

April 18, 1983

Mr. Albert Angrisani
Assistant Secretary for Employment
and Training
U. S. Department of Labor
Washington, D.C. 20210

Dear Mr. Angrisani:

On April 7, at hearings before this Subcommittee on the subject of job forecasting, we learned that both the Job Training Partnership Act and previous CETA legislation mandate the creation of a computerized, on-line national "Labor Market Information and Job Bank" (CETA, Public Law 95-524). Sec. 461(a) of the Job Training Partnership Act instructs the Secretary to "set aside, out of sums available to the Department for any fiscal year including sums available for this title, such sums as may be necessary to maintain a comprehensive system of labor market information on a national, regional, State, local, or other appropriate basis, which shall be made publicly available in a timely fashion."

Legislation requiring such a data bank dates back to at least 1978, but we learned during our hearings that the Department has made little progress in developing a national labor market information system. Joyce Kaiser, the Associate Assistant Secretary, and Burt Barnow, Director of Research, represented the Employment and Training Administration at the hearings. Ms. Kaiser testified that the Department now has a plan for implementing a national job bank program, one which she said could be implemented by the end of the calendar year. Ms. Kaiser told us she would provide us with that plan together with a time table for its implementation.

I am sure you understand that this Subcommittee takes the need for such a system, as documented by a number of witnesses at our hearings, quite seriously. To many in the retraining community in particular, good job information is a necessary and critical first step to designing education and training programs for existing and emerging occupations.

We appreciate your cooperation in providing the Subcommittee with this information about your plans to make the labor market information system work and in keeping Congress informed about your progress in attaining this goal. If you have any questions, please contact Robert B. Nicholas, Chief Counsel/Staff Director, or Bill Skane at (202) 226-3636 of the Subcommittee.

Sincerely,

Albert Gore, Jr.

Albert Gore, Jr.
Chairman
Subcommittee on Investigations
and Oversight

AG:Stk

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U.S. Department of Labor

Assistant Secretary for
Employment and Training
Washington, D.C. 20210

MAY 1 8 1983

Honorable Albert Gore, Jr.
Chairman, Subcommittee on Investigations
  and Oversight
Committee on Science and Technology
House of Representatives
Washington, D.C. 20515

Dear Mr. Chairman:

This is in response to your letter of April 18 requesting information on automation of Labor Market Information (LMI) and Job Bank.

As you indicated in your letter, both the Job Training Partnership Act (JTPA) and the previous Comprehensive Employment and Training Act (CETA) legislation contained direction to the Secretary of Labor regarding job bank and LMI programs. In order to describe the efforts made in each program, it is necessary to differentiate between job bank and LMI.

The term "job bank," which originated in the employment service system in the Maryland State Employment Security Agency in 1968, is a controlled distribution mechanism for employer job orders.

In a job bank, the computer is used to produce a listing of individual job orders on a daily basis for distribution to State Employment Service job placement interviewers for their use in referring applicants to specific job openings.

State/local job banks provide a daily listing of all jobs registered with the employment service in a labor market area. This listing, or job bank book, is updated overnight and a revised edition made available to all employment service office placement staff each morning. In this manner, jobseekers at all employment service offices get current information about suitable job openings available in the entire area. City and area job banks are usually linked in a statewide system so that jobseekers and employers can extend their search to the entire State. Job banks are operating in most States through the State Employment Security Agencies (SESA). This job bank concept, when used on a national basis, i.e., a National Job Bank system, provides for a distribution of job orders which cannot be filled at the local or State level through job banks operating in the individual SESA.

In 1979, a computerized interstate job bank was initiated by the U.S. Employment Service through the Interstate Processing Service (IPS) in the New York State Department of Labor. This provides for the National Job Bank system. IPS receives job orders from SESA`s which cannot be filled within the SESA and distributes these job orders on microfiche cards to all SESA local offices throughout the Nation on a weekly basis, and SESA professional job placement staff search their files to find qualified jobseekers to fill these jobs. Since November 1982, efforts have been and are now underway to improve its efficiency as outlined in the enclosure.

On the other hand, LMI describes the dynamics of employment opportunities and the work force. It is obtained by measuring and evaluating the various factors that influence supply of and demand for workers in a specific geographic area. The comprehensive LMI system includes three major elements: (1) labor force information--data on employment and unemployment and on characteristics of the population, (2) occupational information--characteristics of occupations and jobs, and (3) job search information--description of effective job search techniques and summary information pertaining to job openings.

In terms of LMI, the Employment and Training Administration (ETA) has, over the years, worked with States to develop LMI programs. Such programs in the States vary depending upon individual State discretion, needs and resources. Presently, on a national basis, a summary of frequently listed jobs on local, State and interstate job banks are published and distributed monthly. ETA is presently developing plans consistent with and supportive of JTPA which would provide expanded data for assistance to the unemployed as well as data to assist planners in designing appropriate education and training programs.

Sincerely,

Albert Angrisani

ALBERT ANGRISANI
Assistant Secretary of Labor

Enclosure

Plan to Improve National Job Bank

The National Job Bank system currently in operation makes use of the SESA system. Each SESA is an independent entity which can operate its local and statewide labor exchange as it perceives the needs of its local and State economies.

At the State and local levels, speed in filling a job order is important. The ability to find a qualified jobseeker within the labor market area must be done as rapidly as possible by wide distribution and exposure of the job orders within the area and by searching applicant files. Most orders in the ES system are filled at the local level and most job requests from employers tend to be for nonprofessional, nonmanagerial occupations. Professional jobs and those with higher wage rates tend to have more interest to jobseekers on a nationwide basis.

On a nationwide basis, response in filling job orders is equally critical. Those jobs which cannot be filled within a local labor market need immediate access to jobseekers in the Nation. The present National Job Bank provides for a 10-day turn around of orders in the distribution process, requires SESA's to mail paper copies of job orders to the National Job Bank center and provides SESA's with a weekly listing of job orders on microfiche cards.

The following efforts for improving the National Job Bank mechanism were initiated in November 1982:

- Three 2-day regional training conferences were held in March 1983 to discuss improvements to the National Job Bank with representatives from SESA's and the employer community.

- An administrative directive was prepared and distributed to all SESA's outlining improved procedures for the National Job Bank to include:

  1. An automated job order submittal that will eliminate local and State office paperwork now needed to enter job orders. It will enable each State to use its computer to extract these orders from its job bank. Each State will prepare a tape for weekly mailing or computer transmission to the Interstate Processing System (IPS) in Albany. Besides eliminating unnecessary paperwork and saving staff time, the resulting interstate listing should be large enough and current enough to merit serious attention by local office interviewers and applicants.

2. An automated interstate job order transmittal to States that will increase State flexibility in receiving interstate orders and in sending them to local offices. States receiving a master tape of interstate job orders will be able to transmit them to local offices using the existing State system, either directly by including them in their State matching system, or by preparing hard copy or microfiche. States lacking the capability to process the tapes may continue to receive microfiche.

3. An interstate referral and placement information system that will provide the necessary flow of information between order holding offices (OHOs) and applicant holding offices (AHOs) and will provide the information needed to show that the improved IPS is cost effective without increasing SESA reporting burdens.

- SESA's were directed to provide their plans for use of the improved system by June 1, 1983.
- Improved system implementation by all SESA's scheduled for the summer of 1983.
- Assessment of implementation efforts will be made during the first half of Fiscal Year 1984.
- Implementation of telecommunication techniques will begin in October 1984.

Ms. KAISER. But one of the other things that I do have to mention was that what happened was fragmentation, in terms of implementation of job banks, and job matching over the past 7 years. Although it may not be inexpensive in the great scheme of things to put together such a program, in some cases, it may require that we throw out much of what is already in existence. That has been the frustration, I believe, because States, in fact, were allowed to go to all different kinds of systems that were not necessarily compatible with a national system.

Mr. GORE. Congressman Volkmer.

Mr. VOLKMER. Yes, I would like for you to tell me, when we have the job training on the local bases and workers are being retrained within a local area for jobs within a local area, what happens in the areas where there are no jobs to be retrained for, where you have high unemployment with the structural industry that in all probability will not return, or will return at a reduced rate? How do you retrain those people to work elsewhere, maybe 1,000 miles away?

What are we doing about that?

Ms. KAISER. That has always been a very serious problem in that workers are reluctant to relocate, very reluctant to relocate. The training of workers for occupations in other areas has not been terribly productive because of that problem.

In many cases, individuals will take the training and then move away, but they will come back because the family structure is there. I really do not have an answer to that problem.

Training is offered, people take it, it has just not been very successful.

Mr. **Barnow**. In the Downriver project, for example, where the unemployment rate is very high, the Detroit area, approximately 8 percent of the participants have been relocated. There is not a strong interest on the part of the participants to relocate, but those who are interested are provided financial assistance to go to interviews in other cities, up to $600, plus additional relocation allowances if they find a job.

Mr. **Volkmer**. Maybe they are isolated instances, but I have read stories of people traveling from the west coast to the east coast looking for jobs; people from the east coast to the west coast looking for jobs; and people going to the Sun Belt from the North looking for jobs. There are people who will move.

Ms. **Kaiser**. Oh, yes, it is clear that there are people who will move.

Mr. **Volkmer**. Can we not identify those people? Are you trying to retrain some of these people?

Ms. **Kaiser**. That has been tried, too. there are questionnaires used when you put together a training program and you do, in fact, ask people, are you willing to relocate? The answer can be yes at the time, and then when the point comes that they are going to have to move, they will not go. It is very difficult to read into the future.

Individuals who are younger, who have less attachment to home in terms of mortgage may move. Selling your house is not easy in a depressed community and in many cases cannot be done.

So that the mobility of the work force, I think, is almost a product of how many material things they have acquired. I should also say wife and children or husband and children; that enters into it, too.

Mr. **Volkmer**. Thank you, Mr. Chairman.

Mr. **Gore**. Now, in your training program at Downriver, you stated that 57 percent of the workers elected to receive training, but that younger and better educated workers were much more likely to take advantage of the opportunity.

Why is that, and what does that say to you about the potential for retraining our older workers?

Ms. **Kaiser**. You want to try?

Mr. **Barnow**. I do not have the exact figures on how much more likely. I remember the—I can provide those. The big break was at 55, workers who were 55 and older were much less likely to get retraining. Many of them, presumably, decided to retire, rather than get retrained.

Ms. **Kaiser**. I guess "younger" is a relative term, depending on who you are.

Mr. **Gore**. OK, that was not clear and I appreciate you clarifying that.

Do any of your six current demonstration projects concentrate on preparing people for jobs with a high component of new technology in them?

Ms. **Kaiser**. Burt.

Mr. **Barnow**. Yes, several of them are. In the Downriver area, too, there is a significant amount of high-technology training. I believe they are also doing a fair amount of high-tech type training in either Yakima or the Willamette Valley, I cannot recall which one. Several of the others are also doing some high-tech training.

Mr. **Gore**. The criticism of your methodology right now, Ms. Kaiser, is that the technique you use blinds your agency to the possibility that new occupations are appearing that are not just a gradual increase in trends that we can measure from near-time past, but really constitute something new and that some of the major new opportunities are going to be in areas that cannot be measured by your techniques and that to that extent, your projections are inaccurate.

Ms. **Kaiser**. I am sorry, I am not understanding what "my techniques" refers to.

Mr. **Gore**. I am talking about the BLS projections that you rely on. Do you agree or disagree with that criticism? We have heard it from several people.

Ms. **Kaiser**. Well, I think I disagree and I will go into an explanation of that. Because we do not design the training programs at the Federal level, and because it is our feeling, as I said before, that the State, local people, specifically, and employers have a better fix on what the job opportunities are going to be, that that is the best technique to use in terms of what kind of training should be offered.

It is difficult to say—or I would personally think that it would be inappropriate for us to train people for jobs that do not currently exist.

Mr. **Gore**. Well, that is not precisely what I am getting at, but what do you think of the voucher system that was proposed by Mr. Choate?

Ms. **Kaiser**. I think that that would have to be looked at in terms of the impact, budgetary impacts, number one; number two, whether we would have to make a very clear determination of who is structurally unemployed, that the kinds of programs that would be allowable would have to build on existing skills if that were possible.

One of the difficulties I think you have with any of these kinds of programs is the low-skill worker who is working, and may be in a job considered to be marginal by that individual; versus someone who is now unemployed.

Why should the unemployed person be entitled to this voucher and the person in a low-skilled job not entitled? There is an equity issue that I find difficult to resolve.

Mr. **Gore**. Presumably, by the terms of your logic, if the State organizations are better capable of making intelligent choices about what training is relevant than the Federal Government is, presumably the people who are searching for training would be better equipped still to make better choices.

Ms. **Kaiser**. Well, I am sure of that, however, the issue still remains the equity of the situation. If someone asks me whether I was underemployed, I might be willing even to say that because it is potentially possible that I could take a voucher and get a better job.

That is the issue, I think, that I would find the most difficult to resolve.

Mr. GORE. OK.

Does the minority counsel have questions?

Well, let me thank you very much.

Congressman Durbin, you do not have questions of this panel.

Thank you very much for your attendance here today and we will look forward to seeing you in the first quarter of the next fiscal year or maybe at the conclusion of the first quarter of the next fiscal year.

Our next witnesses will appear as a panel; they are our final witnesses in these hearings. We have four. Dr. Daniel Przybylek is the dean of continuing education at Community College of Allegheny County in Pittsburgh; Marshall Goldberg is at the UAW-Ford National Development and Training Center in Dearborn; Francis Tuttle is Director of the Oklahoma State Department of Vocational and Technical Education in Stillwater, Okla.; and Michael Odom is with the Digital Corp. and the Hubert Humphrey Occupation Resources Center in Roxbury, Mass.

We are pleased and honored to have the four of you with us for these hearings. We appreciate your attendance very much.

Without objection, we will include the full text of your prepared statements in the record and we will invite you to proceed with your oral presentation, beginning with Dr. Daniel Przybylek, Dean of Continuing Education at the Community College of Allegheny College in Pittsburgh.

If you would swing that microphone around there so we could better hear you, Dr. Przybylek, we are delighted that you are with us and please proceed.

[The biographical sketch of Dr. Przybylek follows:]

DANIEL C. PRZYBYLEK
1413 Parkview Drive
Allison Park, Pennsylvania 15101
(412) 237-2618 (W)
(412) 367-1379 (H)

MARRIED: Three Children

BACKGROUND SUMMARY: Over 12 years of college administrative experience. Nine years as a dean of a comprehensive division with a million plus budget, two bargaining contracts, and a history of progressive growth. Six years experience in private industry and government.

EDUCATION:
B.A. Duquesne University
Teacher Certification, Edinboro State College
M.Ed., University of Pittsburgh
Advanced Graduate Studies, University of Pittsburgh
Ph.D., University of Pittsburgh

PROFESSIONAL ACCOMPLISHMENTS

Developed, organized and implemented and sustained one of the largest adult education programs in the Commonwealth. 2500-3000 annual FTE's. 75-100 Full time faculty involved. Over 500-700 part-time instructors involved each semester.

Improved the responsiveness of an institution in meeting community needs. Developed an educational consortium of a City Parks and Recreation Department, a school board, and a college which is becoming a major program in the revitalization of neighborhoods.

Designed and managed a major career training center in area of high unemployment.

Implemented and managed a Labor Education Center.

Designed and implemented and managed a Mill College, (in existence 10 years), which was featured in a major corporate stockholders report.

Designed, acquired grant funds and implemented a Chefs Apprentice Program. Assisted faculty in acquiring funds to export program to eighty-two cities in United States.

Designed and competed and won a major Job Corps Contract. Included: design of educational program, technical training program, budget, and residential living program. (Consultant)

Hired and trained a staff of over 100 to implement an inner city poverty program to recruit and train the unemployed.

Designed, implemented, and managed an innovative youth career guidance center for Department of Labor.

Recognized as an expert in Manpower planning. Recommended for membership on National Manpower Advisory Board.

Recognized as a leading training consultant for smaller businesses. Man of Year of Smaller Manufacturers Council 1976.

Developed and managed innovative marketing program for a major American Refining Corporation.

EMPLOYMENT HISTORY:

Dean of Continuing Education
Community College of Allegheny County
Allegheny Campus. Developed and manages one of the largest adult education programs in the State of Pennsylvania. Responsible for 2,500 FTE's (15-25,000 headcount per semester and 900 Summer School FTE's) continuing education program; credit and non-credit, conferences, seminars, workshops and industrial services, summer school, Labor Education Center, eighteen off-campus centers and prison programs. Administers a budget of 1.5 million dollars (Employe 700 faculty per semester).
August 1971 - Present

Director of Evening College and Continuing Education
Community College of Allegheny County
Boyce Campus. Responsible for starting an evening college and an off-campus, industrial education program. Went from 250 to 1,600 FTE's in two years.
June 1968-August 1971

Project Director, Pittsburgh O.I.C.
(Opportunity Industrialization Center).
Hired, organized and trained the management, designed curriculum, recruited staff, trained staff (100 employees), implemented and managed total administrative, education and training system for a Black self-improvement vocational school.
May 1967-1968

Assistant Manager
Youth Opportunity Center, Bureau of Employment Security, Pgh. PA. Supervised staff that recruited, tested, counseled, screened and enrolled unemployed and underemployed youth in Manpower development, apprentice and state and federal funded job training programs.
February 1965-May 1967

Classroom Instructor, Erie School System.
Taught Western Civilization and P.O.D., a class in Economics. Was given an "exemplary" evaluation.
September 1964-January 1965

Area Manager, Ashland Oil Corp.
Responsible for wholesale, retail, consumer, industrial and farm sales in Northeastern Ohio. Worked with area banks in financing new construction and backing individual proprietors.
January 1962-January 1964

Personnel Specialist, U.S. Air Force
Strategic Air Command. Served in Arctic, South Dakota and Illinois. Varied experiences from job classification and Manpower Planning experiences and payroll operations.
June 1955-January 1959

HOBBY: Farming and Public Speaking

SPECIAL TRAINING: Human Relations
Race Relations
Labor Relations
Career Development
Program Design and Evaluation
Marketing and Sales

BOARD MEMBERSHIPS: Former International Vice President, Society for Advancement of Management, Division of American Management Associations. Vice President for Student Chapters 1974

Mayor's Youth Advisory Board,
January 1978 to Present

Private Industry Council
Secretary and Assistant Treasurer
April 1979 to Present

Vice-Chairman
Private Industry Council
June 1981 to Present

STATEMENTS OF DANIEL PRZYBYLEK, DEAN OF CONTINUING EDUCATION, COMMUNITY COLLEGE OF ALLEGHENY COUNTY, PITTSBURGH, PA.; MARSHALL GOLDBERG, UAW-FORD NATIONAL DEVELOPMENT AND TRAINING CENTER, DEARBORN, MICH.; FRANCIS TUTTLE, DIRECTOR, OKLAHOMA STATE DEPARTMENT OF VOCATIONAL AND TECHNICAL EDUCATION, STILLWATER, OKLA.; AND MICHAEL ODOM, DIGITAL EQUIPMENT CORP. AND HUBERT HUMPHREY OCCUPATIONAL RESOURCES CENTER, ROXBURY, MASS.

Mr. PRZYBYLEK. Thank you very much, Mr. Chairman. I feel very comfortable after many trepidations. I am more or less one of these account executives or AG extension people that the earlier speakers talked about.

I had great trepidations coming here because I am a practitioner, a person who implements—designs and implements programs; I am not a philosopher. But after hearing Mr. Dunlop at the NAB convention and later on President Reagan's presentation and this morning Ms. Kaiser's presention, we have a model that might be of some interest to you gentlemen.

Our model is called the Job Task Analysis Model for Cross-training Skilled Workers. By "cross-training," I am referring to the fact that we do not start from scratch; we take workers and build on to their previous background skills, levels, and abilities. Basically, I wanted to talk briefly about the model and then talk about two applications where we took unemployed displaced millwrights from our local steel industry and cross-trained them for our new buildings in Pittsburgh as stationary engineers.

The second application is where we are taking people displaced, who had been trained in electromechanical trades and training them for robotic repair.

Basically, the model deals with the labor market analysis where we identify a need, then we identify the job categories of unemployed workers and we look at what pools of people who are laid off, what are the categories, what kinds of talents, skills, and backgrounds do they have?

Then we look—we try to do a cross-comparison dealing with the jobs that are open and the people who are available. We do a job task analysis of the jobs that are open and the people who have previous backgrounds and try to do some cross-comparisons.

Basically, when you do the comparisons in the job task analyses and you find that, say in the case of millwrights, when you compare them to stationary engineers, the jobs are highly similar. The differences when you compare the job task analyses, the differences, or the gray areas, give you the curriculum construct on which to base your job-oriented training program.

Again, we deal with the local employment service. When we announce that we have a training program, we have the employment service advertise, recruit, screen, and refer the people to the college. Again, in all these programs, we have advisory boards where the personnel directors who will be hiring these new workers help us in the final selection of the candidates, the finalists, and actually recommend the finalists to us.

We train them, and then these advisory boards stay in existence to help us place the people. This is a very cost-efficient model because usually the training is short term because we are building onto backgrounds, rather than trying to restart and recreate.

Allow me to give you a short case study dealing with the millwright-to-stationary-engineer program. In Pittsburgh, we have what we call Renaissance II, which is a 5½ billion dollars' worth of construction going on in the downtown area of Pittsburgh.

Again, if you look at our labor market, it is a disaster. We have a huge unemployment level in Pittsburgh. But if you look at that 5½ billion dollar's worth of construction going on, we know that jobs are going to be created somewhere. So we do not have an econometric model for forecasting jobs; we are doing more along the lines of what I call, in terms of colloquialism, a Kentucky windage approach, where we looked at the buildings and basically, we knew something was going to go into them as buildings because realtors are renting those buildings.

The first category that we identified was a stationary engineer. Again, we had very excellent support from the United Steel Workers of America, Mr. Odorcich, the administrative vice president. We worked with the union to assemble manpower data and we worked with the building owner and management association, which helped us do the job task analysis for the stationary engineer.

Again, we looked at what skills the millwrights had; we looked at what skills the new stationary engineers had; and the differences became the construct or the blueprint for our curriculum.

One of the things that made this interesting, this was a mixture of high tech and low tech, the millwrights brought a certain background with them. One of the problems in Pittsburgh is that one of our firms which supplies the steam heat to the downtown buildings is going bankrupt and most of these ultramodern buildings had to put in boilers. Nobody ever thought they would have to work on a boiler anymore. So the people from the steel industry had boiler-oriented experience.

Also, we went from—we taught them the fundamentals related to the differentials or dissimilarities in the job task analyses and took them up to programable controllers because most of the controls and most of the AGEC systems in these new buildings are run by computers.

It was a highly successful training program and we had good corporate participation. Galbreath Realty, the largest realtor in Pittsburgh, and Oliver Realty, Gateway.

Now, moving to that was almost like General Doolittle flying over Japan. The steel industry is terribly depressed and we needed something to build a little confidence and say that we can do something right now.

So the next step we took was the development of a program to train—cross-train—people who are considered displaced and there is no place for them to go other than maybe move across the country. We took people from the steel industries and from some of our other manufacturing facilities who had backgrounds in electronic instrument repair, backgrounds in electricity, electronics, but mainly people with backgrounds in electromechanical repair.

Again, the labor market analysis is not there. One of our local companies just sank $100 million into robotics and purchased another robotics firm in Boston and they had 16,000 inquiries dealing with the sale of equipment and no sales because the capital equipment market is a disaster.

But we are confident that in 8 months, when these people will be graduated, they will be readily employed as robotic repair technicians. Nothing esoteric, people who will set up, install, and repair robotic or flexible automation equipment.

Again, we have had good support from Westinghouse. They gave me the necessary robotic equipment to run the classes, and more importantly, in all these programs, I use our full-time faculty to teach the academics, and I use the part-time people I bring in from industry to teach the specialty courses, because as a college, we cannot afford electronic engineers with a background in robotics.

So Westinghouse has been very good in the support of this project in terms of making the part-time faculty available to me in late evening hours.

We are moving on to the point where the steelworkers and the executives from Westinghouse and another company locally by the name of D'Appalonia are assisting me to plan what we call Factory Automation Institute. We know that robots is just one aspect of technology that is going to confront industry, and especially manufacturing.

Through the Factory Automation Institute, we are looking at the cross-training of displaced workers across the entire gamut where we train machinists and machine operators on through clerical people in computer-integrated manufacturing and management, computer-assisted drafting, computer-assisted drafting, computer-assisted manufacturing, robotics, warehousing, shipping/receiving, and the up-to-date fundamentals.

Again, through the partnership that we have established with the labor and industry, I have the high-par instructional talent to give me the direction and create the curriculum for me.

Again, we get down to one of the biggest problems that was discussed by you, Mr. Chairman, this morning. Yesterday, most of the people in the park who were jeering and carrying placards, it is my intention that they would have been carrying schoolbooks if they would have been told you are not being called back.

Many of them have been laid off for 18 to 24 months. Layoffs and cyclical trends happen to be part of our sociology in the tristate area. We have always experienced upturns and downturns. Our present mayor and myself, our generation, the mills were not hiring or we would probably have been in the park yesterday. We went into the Air Force. When we came back, the mills were not hiring again, so we got professional.

Again, one of the biggest problems again is this factor, and nobody is to blame because it is a terribly complex issue. Initially, I thought it was one of morality and integrity, but when you look at severance pay and all of the other intricacies there, it is a very difficult aspect for a major corporation to tell workers that you are not being called back.

But I think this is a definite area that the committee should address in terms of looking at ways it is being done in other countries, and it has been done by other American companies. We have to look at ways to bring about this kind of communication, and again, you might find that if we told these people the day that they were laid off that they are not coming back, that we do not need a voucher.

The money is already there in terms of savings in terms of unemployment compensation fund. As you know, Pennsylvania is now, what, $3 billion in debt for UC. But again, we are looking at—the key words here are "cross-training." In my model here, I would be less than truthful to say that it is a model of my own making. The ingredients here go all the way back to 1938-39, the War Mobilization Act—war mobilization effort of Bernard Baruch and if people understand the Dictionary of Occupations Titles and understand how jobs are developed in terms of job classifications, categories, et cetera, worker traits arrangement, anybody could have done what I am doing here.

That concludes my statement, Mr. Chairman.

[The prepared statement of Mr. Przybylek follows:]

Statement of Dr. Daniel C. Przybylek, Dean of Continuing Education

Mr. Chairman, allow me to introduce myself. I am Dr. Daniel Przybylek, Dean of Continuing Education of the Allegheny Campus, the center city campus of the Community College of Allegheny County. Since 1962, I have been actively involved in employment-directed training projects. I began recruiting and designing programs for the Area Recovery Act, later in sequence I worked closely with the O.E.O. and the Youth Opportunity Centers, the Concentrated Employment Program, Manpower Development Training Act programs, Opportunities Industrialization Center, Inc., CETA, and at present I serve as the Vice-Chairman of the Joint City-County P.I.C. for Pittsburgh-Allegheny County.

I have been asked to provide testimony pertinent to several projects which I began during April, 1982. At that time, the crises in the Steel Industry had reached a peak. Many local unions collaborated with local units in government to develop Job Search Programs. An immediate crisis developed over the question: Search for What? The economy in Western Pennsylvania was down and thousands of Steelworkers were displaced. No one was hiring! At that time, representatives from the College's Phillip Murray Labor Institute introduced Mr. Andrew Koban, the chief assistant to Mr. Joseph Odorcich, the Administrative Vice President, of the United Steelworkers to the College. Mr. Koban was responsible nationally for administering U.S.W.A. matters related to plant shut downs and closings.

With my previous training from the Employment Service and Mr. Koban's experience, we designed a JOB TASK ANALYSIS MODEL for the cross-training of displaced skilled workers. We analyzed the local labor market changes and identified five projects. These five projects which comprised the model developed, each featured the following:

THE PROJECT MODEL

1. A labor market need was identified.
2. Job categories of unemployed workers with similar levels of related training and work experience were identified.
3. A job task analysis cross-comparison of the jobs and a "goodness of fit" test to match previous training, levels of education, duties, tasks, and responsibilities is completed.
4. Specific job categories that relate closely to the job openings are established.
5. The differences between the job task analyses and the dissimilarities between the old and the new job provides the construct for the training curriculum development process.
6. The local Employment Service advertises to alert individuals with specific training and work experience that the College is starting a cross-training project.
7. The local Employment Service office recruits, screens and refers to the College.
8. The College provides academic tests, and if necessary provides job proficiency exams.

9. An advisory board of personnel directors is convened which interviews the candidates and recommends to the College the finalists for training.

10. The College provides the training—usually funded by the State Office of Education or a Governor's Discretionary Grant.

11. The advisory board stays in existence to assist the College to develop jobs and to place the graduates.

This model with five phases was developed to perfect our approach. The first phase of the model was a project to cross-train thirty displaced skilled millwrights to become stationary engineers. Through Mr. Koban's assistance, the steel company representatives furnished a team of assistants, and the local Employment Service did the screening and recruitment of applicants.

The local chapter of the Building Owners and Management Association (BOMA) adopted the project, and appointed Mr. Jack Coughlin, an executive with Pittsburgh National Bank to build support amongst the building owners and managers of the downtown high-rise buildings. The 5½ billion dollars invested in Pittsburgh's new high-rise office structures provided a labor market outlook sufficient to warrant a special grant from the Governor's Discretionary Fund.

A special task oriented curriculum was designed. Through the job task analyses cross-comparisons, thirty (30) displaced millwrights were cross-trained in five weeks (150 hours). The project was cost-efficient, and the first phase of the model was a success. Building on to the previous education, training, work experience, duties, tasks, and responsibilities of these talented displaced workers, the five week cross-training project provided the local building owners with an uncommon pool of top talent to fill complex stationary engineer positions.

This project is exportable. Through the United Steelworkers of America and the Building Owners and Managers Association (BOMA), the project will be implemented in other cities, to serve other displaced industrial workers.

The second phase of the model calls for cross-training displaced skilled workers with previous education, training, and work experience in the areas of Electronic Repair, Instrument Repair, or Electro-Mechanical Repair for new skills as robotic repair technicians. A pool of 130 displaced workers were identified by the local Employment Service offices. Twenty individuals will be selected for training. Several executives from Westinghouse's Industry Automation Center have joined our team on a part-time basis and have assisted in developing a job task oriented curriculum. Again, this curriculum may change, based on the incoming skill levels of the trainees. We build on to the previous level of skills.

Allow me to pause and explain what I mean by displaced skilled worker. In our incoming classes the student profile will resemble this:

1. Is a middle aged worker with good work record;
2. Provides a cross-section, caucasian, black, male, female;
3. Is a high school graduate;
4. Is often a veteran with specific technical training and job experience;
5. Has post high school training and technical education;
6. Has completed a corporate apprentice training program (2,000 hours of on-the-job training and 144 hours of education x four years);
7. Has often had ten (10) years of successful technical related employment;
8. Most often has attended post-apprentice upgrading training.

It is our contention that we need to identify this type of "talent" and actively seek to cross-train them to promote economic development. The displaced skilled worker is a potentially very valuable resource. Just as we dipped into the pool of unemployed and selected thirty (30) millwrights to become cross-trained as some of the finest stationary engineers that local industry has had—we intend to cross-train twenty of the finest Robotic Installation and Repair Technicians for local companies.

The Robotic Technician program will require eight (8) months of cross-training. It is questionable how long it would take—using traditional training program models where you "start from scratch"! The Robotic Technician project will progress into the development of the Factory Automation Institute whereby the College will be providing large and smaller manufacturers with a range of training services for the cross-training of displaced skilled workers.

Governor Thornburgh funded the first phase of the Robotic Repairperson Training Project through his Discretionary Fund. Another unique feature of our projects is the fact that they are planned for late afternoon—evening operations. We use our College faculty for the academic instruction, and call upon part-time instructors employed as specialty engineers or technicians by local corporations. For example, our robotic-related faculty will include a top manager from the Westinghouse Industry Automation Center, the manager of the Westinghouse Robotic Lab, and other engineering talent from local companies. Normally, the College's salary schedule is not competitive in attracting this kind of talent, but this talent is available on a part-time instructional basis.

Additional projects call for the cross-training of displaced skilled workers as computer software users. Again, by identifying top unemployed talent, we will be providing our local companies with upgraded training sevices. This project was designed by Mr. Don Shaw, the Senior Consulting Engineer for D'Appolonia Consulting Engineers, Inc., a renowned expert in artificial intelligence. Again, the College cannot afford such instructional talent, but it is available to us on a part-time basis.

Another specialized project we will complete in 1983, is a computer program based model to do job task analyses and cross comparisons of an individual's or a group's previous skilled backgrounds, education, training, duties, tasks, and responsibilities. With this "tool" we will be able to generate a significant number of cross-training projects and consulting services for local companies. This project was designed by a local manager of the State Employment Service.

Through the College's Business and Industry Council and the Phillip Murray Institute of Labor Studies, we are taking steps to aid local leaders in the restructuring of our local economy. During these critical national and international times, it is my contention that none of us can ignore the wealth of skilled talent that is in the category—displaced skilled worker. This category of unemployed worker found within the mass of the unemployed provides us with a unique strategy for recovery and re-industrialization.

It is my opinion that Title III of the Job Training Partnership Act does not provide sufficient emphasis on this special category of worker. Also, I am not aware of any incentives provided to employers who identify (early) those workers who are displaced. Too often, companies (because of severance pay issues, etc.) prolong the anxieties of potential recall over a protracted period of time, disrupting Unemployment Compensation budgets and virtually destroying what took decades to create—the skilled worker. I propose to you my concept of Job Task Oriented Skilled Cross-Training as one way to improve the retraining of those who have served us so well, the displaced skilled worker, who with a little help can aid our companies and corporations, and the nation to overcome this economic malaise which we are experiencing. The Displaced Skilled Worker is a major problem—but is also a major strategy for recovery.

BOMI Helps Put People Back To Work In Pittsburgh

(By Kathe Young, Director of Communications, BOMI)

Pittsburgh, a city of high unemployment, is putting people back to work through a unique cross-training developed cooperatively by BOMA/Pittsburgh, BOMI and other interest groups in the Pittsburgh community. Dan Przybylek, Dean of Continuing Education at the Community College of Allegheny County [CCAC], was charged with finding a retraining program for unemployed steel workers by Andrew Koban, assistant to Lloyd McBride, president of the United Steel Workers of America.

Przybylek determined that Pittsburgh would have a strong need for stationary engineers because of five major construction projects that will add 25 percent more office space to the Pittsburgh market in the near future. So, he contacted Jack Coughlin, a BOMA member employed by Oliver Realty, who explained how BOMI's Systems Maintenance Technician (SMT) program, which comprises the first five courses of BOMI's Systems Maintenance Administrator [SMA] program, could provide the necessary training to qualify the unemployed steel workers for jobs as stationary engineers.

Funds for the SMT program were secured from the Governor of Pennsylvania's office because of a letter of commitment to the program from the local BOMA, which stated that BOMA members would do whatever they could to see that program graduates were hired. With a $39,433 grant, the five-week program finally got underway on January 10, 1983.

Students attended class for six hours a day, five days a week from 3 to 9 p.m., so that they could tour the major office buildings after office hours. BOMA assisted in every phase of the program. Jack Coughlin and John Java instructed different parts of the course when instructors could not be found. BOMA's curriculum committee, headed by Jack Coughlin, helped decide where the classes would be held, and what buildings would be used for the hands-on portion of the classes.

BOMA also took an active role in the selection of the 30 students who were ultimately enrolled in the program. The community college put an ad in the paper inviting applications to the program from any unemployed steel worker residing in Allegheny County. Over 400 applications were received, out of which 126 applicants were selected to take math and reading tests to determine whether they could meet the demands of an accelerated training program. Forty-eight people performed well enough on the test to meet the criteria for the accelerated program, but there were only 30 slots available in the program.

According to BOMA member Paul Fisher, who headed up the selection committee, the most difficult part of the entire project was to select the 30 candidates from the 48 who had passed the initial test. Each candidate was closely interviewed to determine his/her ability to talk with tenants and his/her mechanical acumen. Thirty candidates were finally chosen based on the results of the intensive interviewing.

Fisher and Andy Koban of United Steel Workers of America acted as liaisons between the SMT program and Local 95, the operating engineers union. They worked out details concerning carry-over seniority, wage structure and fringe benefits with the union. They also acted as trouble-shooters during a potentially threatening situation when 75 operating engineers were laid off. The union was concerned about their members having to compete with SMT graduates for stationary engineering jobs. Thanks to the negotiating skills of Fisher and Koban the situation was resolved to the satisfaction of the union without placing the program in jeopardy.

Though there were some obstacles in establishing the program, BOMA's Jack Coughlin says that the different interest groups involved were able to confront difficulties and work them out because, "there was not time for Machiavellian manipulation." Coughlin observed "the first time we sat down in some of these meetings, we just sat across the table and glared at each other. But, we rose above it because we had to. People are hurting here in this town."

This spirit of cooperation expedited the program's development. Paul Fisher says that not a single person said "no" when asked for anything involved with the cross-training program. The enthusiam extended to the students themselves, of whom Fisher says, "These people are hungry. They have been laid off for so long that they are eager to do anything they can. They make excellent students. I would hire any of them."

A spectacular graduation ceremony was held on February 22, with BOMA/Pittsburgh and John W. Galbreath & Co. financing it. The ceremonies were held in the lobby of the 45-story Mellon Square Building, which is still under construction. The site was chosen to emphasize the fact that Pittsburgh is on the mend, and that the construction taking place in Renaissance. Two will bring jobs and help to the city.

The Community College of Allegheny County would like to help start seed programs like the Pittsburgh project across the nation. They will sponsor a workshop for any local BOMA and educational institute who would like to start a similar program. In addition, several of the key people responsible for the success of the Pittsburgh project are recently retired and would like to help other communities initiate a cross-training program. Contact Dick Muzik at the BOMI office [301] 974-1410 if you would like more information on developing a cross-training program for your community.

Max Wensel Appointed Regional Vice President for BOMA International's Southwest Region

Max Wensel, a senior vice president for Liberty Property Management Company in Oklahoma City, Oklahoma was recently appointed as a BOMA International regional vice president for the Southwest Region. Wensel is a past president of BOMA/Oklahoma City and has been a member of BOMA International for the past 10 years.

Wensel has been with Liberty National Corporation since 1971. Prior to that he was a project engineer with the H.C.B. Company in Dallas, Texas. Wensel is a native of Kansas.

Local BOMA's Challenge Occupancy Pessimism

As Stewart Huey, executive director of BOMA/Atlanta, wrote in a late 1982 issue of the Atlanta newsletter: "We would take this opportunity to repeat our concern about the pessimism which the business press and other commentators show for our industry. A 15 percent vacancy rate is substantially higher than rates reported by other major cities throughout the United States; however, it is a condition that the real estate industry in Atlanta has learned to live with.

"It is important to remember that the ten year average of vacancy rates is 16.6 percent, that we are substantially below that, and that we are in the middle of an improving trend."

Huey's remarks have been echoed by other BOMA spokesmen in cities with high vacancy rates across the country. As Elayne Kilgore, executive director of BOMA/Chicago said, "Much is being written these days about office space; brokers are saying the market is good, while owners, and managers are, at the same time, wringing their hands in the battle to sustain buildings with dwindling populations."

Kilgore, like other BOMA members in cities where there is an oversupply of space, felt that things would straighten out in the future: "In these times, it is difficult to predict what will happen to office space, but the market in Chicago has weathered other gluts of space. By considering the past, it is certainly possible to assume that the city will handle the present situation as well."

In Houston, BOMA's Executive Director W.D. "Dub" Hill reports that 79 new office buildings representing 22.2 million square feet of space will be opening within the next 16 months. "Look for fewer new starts in 1983 and 1984," said Hill.

MEG MORRIS JOINS BOMA INTERNATIONAL STAFF AS LEGISLATIVE ASSISTANT

Margaret M. (Meg) Morris has joined the Government Affairs staff of BOMA International as a Legislative Assistant. Ms. Morris will be tracking all federal legislation impacting BOMA members and attending hearings on Capitol Hill relating to BOMA issue.

Ms. Morris previously worked as a Government Relations Specialist for the Brick Institute of America, the national trade association representing brick manufactures. She has a broad view of the legislative and regulatory issues as they relate to the brick industry in particular and the construction industry in general.

Ms. Morris graduated from the University of North Carolina at Greensboro with a Bachelor of Science degree from the School of Business and Economics. She is a native of the Washington, D.C. area.

[From the Pittsburgh Press, Jan. 9, 1983]

DISPLACED WORKERS SOUGHT FOR JOBS REPAIRING ROBOTS

Recycle displaced industrial workers as robot repair people?

The machinery to do this already is in motion at Community College of Allegheny County. The first class of 20 students will begin training late next month.

Dr. Dan Przbylek, dean of continuing education, conceded this a small beginning, but the program has lots of potential.

The number of robots working in U.S. factories is estimated at 5,000, up from 3,000 two years ago. But this phase of automation is just beginning in American factories.

The nation's robot population will multiply many times to tens of thousands by the end of the decade, Przbylek estimates.

"Behind every successful robot is a technician," he said.

Thousands of jobs will be created to repair and service these electronic wizards that are being counted on to make U.S. industry competitive with plants in Japan and other countries.

The Robotics Center at the Community College is gearing up to upgrade factory and mill workers to qualify for these jobs. Assistance in developing the program has been provided by Westinghouse Electric Corp., D'Appalonia Engineering, Carnegie-Mellon University and the United Steelworkers union.

The eight-month course is being targeted for experienced workers, Przbylek said. This is not a program for high school graduates, although CCAC expects to develop a course for them, he said.

If this program attracts as much interest as the soon-to-be completed millwright-to-stationary-engineer cross-training course for steelworkers did, choosing the 20 recruits will take some doing. About 400 applied for the 30 stationary engineer openings, said Andrew Koban of the USW. These displaced steelworkers will graduate Feb. 18.

There is a reason for limiting the number of students in these classes, Koban said. "We don't want to train more people than there are jobs."

The Robotics Center has identified 23 Western Pennsylvania firms that have a need for automation maintenance. This is where the jobs will be at first.

Federal and state incentives—such as tax credits—for employers to hire displaced workers are needed, Przbylek said. This may be a long shot, considering the present political climate in Washington.

Przbylek said the technician who completes the CCAC program will be trained in hydraulics, pneumatics, electronics, mechanics and micro-computer programming. Unemployed workers with experience in these areas will be recruited for the first class.

Koban views automation maintenance as a golden opportunity for the "thousands and thousands of our people" who will never return to their jobs in the mills after business recovers.

"Starting pay won't match the wages they once earned as steelworkers," he said. "But they are good jobs—$18,000 to $20,000 a year."

A lot of steelworkers already have developed some of these skills repairing mill equipment and machinery, he said. "They just have to be upgraded."

State funds are being sought to pay for the tuition, Przbylek said. "Our goal is to have a going institution in three years." If all goes well, the second class could start as early as June, he said.

"When we advertise for recruits in Feburary, we'll be making an appeal to middle-aged workers," he said.

Nick Yaroshuk, manager of the Westinghouse Automation Division, said "thousands of jobs" will be created to support the growing automation market which he sees exceeding $1 billion in the '80s.

Robotics will provide business opportunities for smaller firms, said Harold G. Hall, president of Hall Industries Inc. He said the South Side company is positioning itself to service robots once big manufacturers have made the transition to automation.

Community Colleges in Chicago and Michigan have established automation maintenance programs similar to the one at CCAC, Przbylek said. And CCAC has taken a lesson from them in setting up its course.

But he doesn't think they have the same high-quality talent—CMU, Westinghouse and D'Appalonia—as CCAC for support.—By William H. Wylie.

WE TO PURCHASE ROBOT COMPANY

Westinghouse Electric Corp. said it has signed a definitive agreement with Condec Corp. to purchase Condec's 78 percent interest in Unimation Inc., a manufacturer of industrial robots, for $84 million in cash.

It also was announced that Unimation, Westinghouse, and Westro Inc., a wholly owned subsidiary of Westinghouse, have entered into an agreement providing for the merger of Westro into Unimation. The transaction is subject to governmental reviews.

Westinghouse Chairman Robert E. Kirby said the agreement provides that Condec will vote all of its shares in favor of the merger at a meeting of the stockholders of Unimation, which is expected to be held in mid-February.

[From the Pittsburgh Business Times, Feb. 28 to Mar. 6, 1983]

WE DONATES ROBOTS TO RETRAINING PROGRAM

(By Claire Simmons)

Westinghouse Electric Corp.'s Industry Products Co. has donated three robots to the Community College of Allegheny County for a pilot program to crosstrain unemployed workers skilled in electromechanical repair for new careers as robotic repair technicians.

The robotics retraining programs is the second stage of a crosstraining program at CCAC, which is also being organized by the United Steelworkers of America. In the first phase of the program, which began in January, 30 unemployed milwrights were retrained as stationary engineers.

The robotics retraining program received a second boost last week when Governor Richard Thornburgh announced that the state would commit $78,811 to the program. Thornburgh made the announcement at commencement exercises for the 30 retrained stationary engineers. Commencement was held in the lobby of One Mellon Bank Center, which is still under construction.

Thornburgh commended Westinghouse for its involvement in the crosstraining program and said that the company's recent purchase of Unimation, the nation's largest robotics manufacturer, could provide new career opportunities for the program's graduates.

"Westinghouse has demonstrated an outstanding commitment to bringing the people of this Commonwealth back to work," Thornburgh said.

The state had provided a $39,433 grant for the first phase of the program through the Department of Education's Training of Occupations Work Promise fund. The same fund will provide the grant for the robotics program. In his 1983-84 budget. Thornburgh has proposed that the state spend $7 million for job retraining, an investment which would qualify the state for $125 million in a federal grant available under the Job Training Partnership Act recently approved by Congress.

"We are committed to doing whatever we can to combat unemployment," Thornburgh said. "By combining the resources of government, the private sector and academic institutions, we can continue to diversify the skills of Pennsylvania's workforce, and take advantage of economic and job growth in advanced technology fields."

"This is what our customized approach to job training is all about—to give workers the new skills they need for jobs that actually exist," Thornburgh said.

The 30 graduates of the CCAC program were selected from nearly 200 applicants whose jobs were permanently phased out by their companies. About half of the graduates had jobs when they completed the retraining course and the remaining graduates were expected to have jobs later this spring, according to Daniel Przbylek, dean of continuing education at CCAC.

Not all unemployed steelworkers were pleased with the job retraining program. About a dozen members of Jobs of Income Now (JOIN) picketed the commencement cermony, calling Thornburgh's appearance a "publicity stunt." The group also called for more retraining for a larger number of unemployed workers.

PREPARATIONS BEING MADE FOR FUTURE ROBOT INVASION

(By Thomas Neudecker)

PITTSBURGH, PA.—Today's signal is not as simple as "One if by land and two if by sea," but it is just as apparent to educators in Pittsburgh. the revolution is coming, but this time it's not the British but the robots.

The U.S. Subcommittee on Monetary and Fiscal Policy of the Congressional Joint Economic committee sounded the alarm in its March 1982 report. *Robitics and the Economy.* The report states that "as human wages increase and the costs of robots continue to fall, the robot laborer will become cheaper than human ones and the purchase of robot ones will increase profits."

Roger B. Smith, chairman of General Motors, stated that "every time the cost of labor goes up one dollar an hour, 1000 more robots become economical."

The Society of Manufacturing Engineers conducted a "Delphi Study" that yielded the following predictions:

By 1985 the auto industry will continue to be the largest user of robots. The U.S. market will purchase 10,000 units a year, including 2000 imports. Each unit will pay back its cost ($35,000) in 2½ years.

By 1990 the U.S. market will purchase $2 billion worth of industrial robots (20,000 units). The pay-back time will be two years. Robots of this era will feature computer controls and will be adaptive to changing functions. One fourth will have vision., and 20 percent will be tactile/touch sensing.

Dr. Daniel Przybylek, dean at Pittsburgh's Allegheny County Community College, and Dr. Angel Jordon, academic dean at Carnegie-Mellon University (CMU) agree with the report. They also acknowledge that the recession has hit Pittsburgh hard. Some of the steel communities that line the Allegheny and Monongahela rivers have unemployment rates greater than 20 percent.

"If these thousands of skilled workers ever return to the mills they will likely encounter modern manufacturing techniques featuring robots," says Dr. Jim Cunningham of the University of Pittsburgh.

"In order to return, these steel workers will need new skills; otherwise they will be forced to find marginal jobs at a loss of pay." Both the community college and CMU are starting new programs to retrain such workers for these new jobs.

"It's like an airplane crash where a physician follows a triage system in applying aid first to those with the most need and the best chance to survive. We are going to train the most talented and motivated of the unemployed," says Przybylek.

We are working with management and labor to identify workers skilled in electromechanical machines and instrument repair. These people will be trained to become robotic technicians."

This month the community college will admit its first class to the Robotics Technician program. Twenty students will be accepted for the first class in June. There will be fifty students by September and 100 by December 1983. The eight-month program will prepare graduates to install and repair industrial robots.

Prxybylek stated that "other programs exist, but we are unique here in Pittsburgh. We can draw from the best minds, the leaders in robotic engeering, to teach in our program. Our advisory board and faculty are composed of engineers and scientists from such places as CMU's Robotics Lab and Westinghouse's automation Division."

The curriculum will follow a rapid pace similar to military training programs. The initial class of 20 will have jobs upon graduation, and the college expects a major upturn in 1984 with the promise of jobs for future graduates.

The program is being funded with corporate grants and state vocational-education funds. Tuition for the students will be minimal.

To date the college has had 500 applications for the first class, of which 90 percent were qualified. In fact, many demonstrated college-level proficiency in reading and math.

The notion of cross-training is not new at Allegany County Community College. It is currently exploring ten different program options for skilled workers.

On February 22 the college will graduate its first class of millwrights who have completed a program to become stationary engineers. These graduates will be supervising the mechanical, electrical and refrigeration systems of large office buildings. Thirty students started this program and 30 will graduate with jobs, a standard the college hopes to maintain with the Robotics Technician program.

While the community college prepares steelworkers to become robotic technicians. Carnegie-Mellon University is preparing to educate a "new breed of experts in both technology and administration." According to Dean Jordon of CMU, "The university is planning a program to retrain mature, experienced engineers devoted to manufacturing."

The Integrated Manufacturing System Engineering and Management (IMSEM) program is a combination of administration, technology and robotic engineering leading to a master's degree.

Mr. **Gore**. Thank you very much. Very interesting. We will hold questions until the panel has been completed.

Our next witness is Mr. Marshall Goldberg, who is at the UAW-Ford National Development and Training Center at Ford World Headquarters in Dearborn, Mich. We are delighted to have you here, Mr. Goldberg.

As I understand it, you work at the center which is sort of jointly the responsibility of the UAW and Ford; is that correct?

Mr. **Goldberg**. That is absolutely correct. We work for both the corporation and the national Ford department of the UAW. Although it's a unique relationship, it works quite well as a matter of fact.

Good morning. I am here representing the UAW-Ford employee development and training program. We wish to express our appreciation for the opportunity to appear before you today because the subject of dislocated employees and retraining has taken on critical importance as a result of high unemployment, particularly in basic industries such as automotive.

UAW-Ford employee development and training program is an entirely new concept that was developed out of the collective-bargaining process in 1982. The program is specifically designed to meet a broad range of employee development and training needs.

If you view it as a conventional training program, you miss its true meaning, for the program is a joint participatory process of wide scope.

It is a logical extension and application of employee involvement principles which are forming new attitudes and approaches throughout Ford and UAW.

The program has been carefully crafted to serve the individual Ford employee by helping employees fashion answers about themselves, their works, their education, and the training that they want.

The program's principal objectives are to: (1) arrange career counseling, retraining, job search training and placement assistance for laid-off employes; (2) assist in designing and obtaining appropriate career counseling, training, retraining, and personal development for active employees; (3) support local and national UAW-Ford EI efforts and other joint activities; and (4) provide opportunities for exchange of ideas and innovations with respect to employee development and training needs.

The jointly administered training and development program is directed and guided by a joint governing body, consisting of an equal number of company and UAW representatives. The joint governing body has two cochairmen; one of the cochairmen is Donald F. Ephlin, vice president of the national Ford department, UAW, and Peter J. Pestillo, vice president, labor relations, Ford Motor Co.

The day-to-day operations are run from a national development and training center, managed by an executive director with a small staff of professional and administrative support personnel.

The center, the national development and training center, is a driving force to translate the program goals into action. It coordinates and helps develop projects and activities under the plan. We provide onsite assistance to local plant managements and unions to help them design and implement local program applications.

This is done through the development of what we could call an EDTP Committee. We feel that local plant management and local union leadership have the best insight into the training needs of their people, and insight into the community at large.

The national center concentrates on program planning, design and coordinative functions, rather than serving to any great degree itself as an educational training institution. The center relies on existing community educational and counseling resources. We do not feel that we should reinvent the wheel.

We use local community facilities and curriculums to provide specific training and development programs. In this way, we are building a partnership program, a delivery system linking local management, local unions, and community resources throughout the country where Ford facilities are located.

The center will move to its permanent headquarters on the grounds of Henry Ford Community College, Dearborn, Mich., in June 1983.

Funding for the program, the center and its activities, is provided under the collective-bargaining agreement at 5 cents an hour worked, with expenditures authorized and approved by the center's joint governing body.

I would like to give you some specific examples of program activities that are currently underway through the national development and training center. The first one is the national vocational retraining assistance plan [NVRAP], which can help certain employees on indefinite layoff who wish to pursue self-selected formal education or retraining to improve their chances for reemployment within or without the company.

The criteria of the program is quite simple. This is a prepaid tuition assistance plan administered by the national center. The tuition and certain fees are covered up to $1,000 a year, up to 4 years, depending on seniority, for self-selected education training. It was launched in August 1982, initially for employees with 5 or more years of seniority.

Through February 1983, more than 700 course enrollments have been approved. The plan is now being liberalized to cover certain laid-off employees with 1 to 5 years of seniority.

I would like to give you a typical example, or a profile of an employee enrolled in this program. This is based upon the first 600 course enrollments.

The typical employee selected a community college. Enrolled in a vocational education curriculum involving either technology, such as electronics or robotics, or in a business area, such as data processing.

They sought a 2-year associate's degree, not just a few courses, and they enrolled in 1 of 35 community colleges in 10 States. They began studies with a relatively heavy workload, enrolled for almost a full-time load of courses, and had their tuition and compulsory fees paid for the first term by this program.

They received little, if any, additional financial aid from other resources. The typical employee had over 7 years of company seniority and therefore was eligible for 2 years of Navrap assistance for a total amount of $2,000 for an accredited college.

Mr. GORE. What is Navrap?

Mr. GOLDBERG. That was the National Vocation—let me go back to it—National Vocational Retraining Assistance Plan.

Mr. GORE. Thank you.

Mr. GOLDBERG. Acronyms, excuse me.

Some early conclusions: Employees are selecting a wide range of education options. The majority are attending public community colleges and they are selecting college studies with rather ambitious workloads.

The employees are selecting curricula emphasizing vocational education and so far the plan has paid for most covered expenditures. In general, we feel that the plan is working well.

The second major vocational activity is a targeted vocational retraining program. Many dislocated blue-collar employees must obtain new job skills in high-demand and emerging occupations in order to achieve their goal of reemployment.

An effective way and efficient way of providing dislocated employees with new skills, particularly for sophisticated technical occupations, is through group-sized accelerated retraining programs. These are called TVR's, Targeted Vocational Retraining Projects.

They can be tailored to specifically meet the skills demand in a local labor market for demand occupation. Further TVR projects can include additional employment-related instructions, such as basic skills and job search skill development.

Important support services, such as assessment, counseling, job development and placement can also be included. These projects can be an effective and a relatively quick way of retraining large numbers of blue-collar workers.

As with other aspects of the Employee Development and Training Program, UAW-Ford wish to work with, and through, institutions and organizations in planning targeted vocational retraining projects. We have found that many communities have an abundance of education and training resources, including adult ed, community technical colleges, universities, and private occupational schools.

Many of these local resources have the capability to identify, design, and conduct these TVR projects. A project may be a spinoff of an existing educational offering or may be an entirely new program, each being specifically tailored for the retraining and reemployment needs of dislocated employees.

It is the hope of UAW-Ford to link the retraining needs of dislocated employees with the training capacity of local education resources and the local labor market demand.

If I can give you some typical examples of TVR's, targeted vocational retraining projects which are currently running, we have two running at Henry Ford Community College and Macomb Community College in the Michigan area, currently covering over 100 individuals, including laid-off Ford employees from 15 southeastern locations, and 25 individuals from other companies.

This program is being jointly funded by the employee development training program and public funds. The training being provided is in the area of tool and die detailing and high-pressure vessel welding.

Another example project is at Muscle Shoals Technical College, which is in the State of Alabama, with the Alabama Industrial Development Training Agency, for 40 individuals in computer numerical control and programable logic control. This is totally funded by the employee development training program.

Another ongoing program in development and training at the National Center is a special assistance program for plant closings. The center provides onsite consultation for reemployment efforts and help in liaison with government agencies and community resources for the local plant.

We evaluate and help assess local needs through vocational interests and related survey services. We help formalize vocational retraining programs, using the Navrap and the TVR's, the national vocational retraining assistance program and the targeted vocational retraining programs consistent with the employee interests, and again, local labor market conditions, using funds from the National Development Training Center and other funds from external sources.

We are also involved in gathering vocational plans and interest surveys. We gather information on employee career plans and interests and assist local committees in forming their local initiatives, based upon this information.

We design basic surveys tailored to the needs of the individual site and consult with the committees. From October 1982 through February 1983, more than 5,400 laidoff employees were surveyed at 10 locations. We also provide local EDTP, Employee Development Training Program Committee workshops and orientations, we are currently visiting plantsites and providing this type of training for our local people.

We developed material and conducted two regional workshops for local unions and managements covering 11 plants, and we have conducted 15 onsite local orientation and consulting sessions. This is an ongoing process.

We have also developed, with the help of local representatives, what we call career-day conferences, where presentations are made explaining what the UAW-Ford program has to present as far as career guidance and training services.

We also bring together community service people, public agencies, training agencies, who may also provide information on what available resources are there in the community for the dislocated worker.

So far, in 1983, four locations have conducted career day conferences attended by nearly 2,300 laidoff employees.

Another component being developed is career guidance and counseling. This is to provide both active and laidoff employees help in forming and achieving their personal goals. This is a pilot program being run in four areas at this time.

The four main components of this program are to provide help in self-awareness for the individual; career awareness; career decision-making; and career planning.

Another activity we are involved in is providing laidoff employees with self-directed job-hunting skills and professional job search assistance, as a supplement to what is available in certain States from the Employment Service.

Through February of 1983, over 200 employees have been enrolled in these job-search skill programs. We also are piloting a job club, self-directed job-placement approach with 60 employees.

A pilot program also has been developed for active employees for skill enhancement, a self-paced electronics training for electrician-skills enhancement with 30 active employees. We also provide support for the ongoing employee involvement activities through UAW-Ford.

We sponsor national employee involvement educational conferences; we provide assistance for local plant steering committees and EI facilitators; and bring in outside institutions and organizations to provide additional training.

We publish UAW-Ford EI surveys and we have developed a training program on the UAW-Ford EI process.

We have also helped to assist two local committees in a joint educational orientation formulating local pilot employment guarantee plans.

In summary, the UAW-Ford employee development program is unique in a number of ways. It is jointly administered by the UAW and Ford; it provides for training and retraining opportunities for both laid-off and employed employees; its focus is on individual needs and choices; it is responsive to local employee and plant needs and the local labor market; it provides an excellent means to link private and public resources to enhance both work force training and development endeavors.

Thank you. If I can answer any questions?

[The prepared statement of Mr. Goldberg follows:]

Testimony

Submitted

to the

Subcommittee on Investigations and Oversight

Committee on Science and Technology

U.S. House of Representatives

Wednesday, April 7, 1983

UAW-Ford National Development and Training Program

Witness: Marshall Goldberg
UAW-Ford National Development
and Training Center

UAW-FORD EMPLOYE DEVELOPMENT AND TRAINING PROGRAM
INFORMATION SUMMARY - MARCH 1983

PRINCIPAL PROGRAM OBJECTIVES

The jointly-administered Employe Development and Training Program (EDTP) is a key element of the comprehensive interlocking mutual growth framework the Ford Motor Company and the UAW created in their 1982 Collective Bargaining Agreement. The Program's principal objectives are:

- Counseling, retraining, job search and placement assistance for laid-off employes.
- Counseling, training, retraining and personal development for active employes.
- Training and support to enhance the UAW-Ford Employe Involvement process and other joint activities.
- Research concerning employe development and training approaches and needs.

NATIONAL DEVELOPMENT AND TRAINING CENTER

The UAW-Ford National Development and Training Center (NDTC) is the driving force to translate Program goals into action. The National Center is directed and guided by a Joint Governing Body consisting of an equal number of Company and UAW representatives. The Joint Governing Body members are Donald F. Ephlin, Co-Chairman, UAW; Peter J. Pestillo, Co-Chairman, Ford Motor Company; John E. Reese, Ford Motor Company; Dan Forchione, UAW; Elvin C. Hendricks, UAW; Ernest J. Savoie, Ford Motor Company. Day-to-day operations of the Center are managed by an Executive Director, with a small staff of professional and administrative support personnel, including four Program Associates, a Career Counseling and Guidance Associate, and a Job Development and Placement Associate.

The National Center coordinates and helps develop projects and activities under the Program. The Center provides on-site assistance to local managements and unions to help them design and implement local program applications.

The National Center concentrates on program planning, design and coordinative functions. Rather than serving to any great degree, itself, as an educational or training institution, the Center principally relies on existing community educational and counseling resources using their faculties and curricula to provide specific training and development programs. In this way, it is building a participative program delivery network linking local managements, local unions and community resources throughout the country where Ford facilities are located.

The Center will move to its permanent quarters at Henry Ford Community College, Dearborn, Michigan by June of 1983.

FUNDING

Funding for the Program, the Center and its activities is provided under the Collective Bargaining Agreement at 5¢ per hour worked, with expenditures authorized and approved by the Center's Joint Governing Body.

SPECIFIC PROGRAM EXAMPLES

- **National Vocational Retraining Assistance Plan (NVRAP)**

General Overview of the Plan

Ford Motor Company and the UAW are undertaking joint efforts to provide training, retraining and developmental opportunities for Ford employes represented by the UAW.

This example describes one of these efforts for employes who are on indefinite layoff -- a National Vocational Retraining Assistance Plan -- sponsored and administered by the UAW-Ford National Development and Training Center.

The National Vocational Retraining Assistance Plan can help certain employes on indefinite layoff who wish to pursue self-selected formal education or retraining to improve their chances for reemployment within or outside the Company.

Program Information

- Prepaid tuition assistance plan for certain laid-off employes administered by the National Center.
- Covers tuition and certain fees up to $1,000 per year -- up to four years, depending on seniority -- for self-selected education and training.
- Launched August 1982 -- initially for employes with 5 or more years of seniority; through February 1983, more than 700 course enrollments have been approved.

- Plan now being liberalized to cover laid-off employes with 1-5 years of seniority.

Current Program Analysis

The following represents a profile of a "typical" employe enrollment based on an analysis of the first 600 course enrollments:

- Selected a community college:
    - Enrolled in a vocational education curriculum involving either technology (such as electronics or robotics) or in a business area (such as data processing).
    - Sought a two-year Associate Degree, not just a few courses. (They enrolled in one of thirty-five (35) community colleges, in ten (10) states.
- Began studies with a relatively heavy workload:
    - Enrolled for almost a full-time load of courses.
- Had most of his/her tuition and compulsory fees paid for the first term in school:
    - Received NVRAP assistance for about 95% of such covered expenses.
    - Received little, if any, financial aid from other sources.
- Had over seven years of Company seniority and thus was eligible for:
    - Two years of NVRAP assistance, and
    - A total amount of $2,000 for an accredited college.
- Some conclusions:
    - Employes are selecting a wide range of educational options.
    - Majority are attending public community colleges.
    - Employes are selecting their college studies with rather ambitious workloads.
    - Employes are selecting curricula emphasizing vocational education.
    - For most employes, the Plan thus far has paid for all covered expenses.
    - In general, the Plan is working out well.

- **Targeted Vocational Retraining (TVR) Projects**

Many dislocated blue-collar employes must obtain new job skillls in high demand and emerging occupations in order to achieve their goal of reemployment. An effective and efficient way of providing dislocated employes with new job skills, particularly for sophisticated technical occupations, is through group-size, accelerated retraining programs. Accelerated retraining programs or "Targeted Vocational Retraining (TVR) Projects" can be tailored to meet the specific skill training objectives for demand occupations in local labor markets. Further, Targeted Vocational Retraining Projects can include additional employment-related instruction such as basic skills and job search skills development. Linked to important support services such as assessment, counseling, job development and job placement, Targeted Vocational Retraining Projects can be an effective and a relatively quick way of retraining large numbers of blue-collar workers.

As with other aspects of the EDTP, UAW-Ford wish to work with and through established institutions and organizations in planning and conducting Targeted Vocational Retraining Projects. Many communities have an abundance of education and training resources, including adult education programs, community/technical colleges, universities and private occupational schools. Many of these local resources have the capability to identify, design and conduct Targeted Vocational Retraining Projects. The Projects may be spinoffs of existing educational offerings, or may be entirely new programs, each being specifcally tailored for the retraining and employment needs of dislocated employes. It is the hope of UAW-Ford to link the retraining needs of dislocated employes with the training capabilities of local educational resources and local labor market demand.

Current Examples of TVR Projects

- Projects at Henry Ford and Macomb Community Colleges (Michigan area) currently cover nearly 100 individuals, including laid-off Ford employes from 15 southeastern Michigan locations and 25 individuals from other companies through joint EDTP and public funding arrangements. The training being provided is in the areas of Tool and Die Detailing and Pipe and Pressure Vessel Welding.
- Project at Muscle Shoals Technical Collge with the Alabama Industrial Development Training Agency for 40 individuals in Computer Numerical Control and Programmable Logic Control funded by the EDTP.

- **Vocational Plans and Interests Surveys**

  - Gather information on employe career plans and interests to assist plant EDTP committees in forming local activities.
  - Center develops basic survey design; tailors to local needs; processes information; consults with local committees on results.

- From October 1982 through February 1983, more than 5,400 laid-off employes surveyed at ten (10) locations.

o **Job Search Skills Training**

- Provides laid-off employes with self-directed job hunting skills and professional job search assistance (supplements basic state employment service and employment search orientation sessions).
- Through February 1983, about 200 employes have been enrolled in job search skills workshops; job club approach being pilot-tested for 60 employes.

o **Career Day Conferences**

- Local EDTP committee and NDTC representatives explain career guidance and training services available.
- Community and public service agency representatives explain appropriate social programs.
- So far in 1983, four locations have conducted Career Day Conferences attended by nearly 2,300 laid-off employes.

o **Career Counseling and Guidance (CCG)**

- To assist both active and laid-off employes in forming and achieving their personal and career goals.
- Contains four main components -- self-awareness, career awareness, career decision-making and career planning.
- Model components being field-tested.

o **Special National Center Assistance for Plant Closing**

- On-site consultation and help in liaison with government agencies and community resources.
- Evaluation and assessment of local needs through vocational interest and related survey services.
- Formal vocational retraining programs, including NVRAP and TVRs, consistent with employe interest and labor market conditions, under NDTC sponsorship and other funding from external sources.

- **Local EDTP Committee Workshops and Orientation**
  - Developed material and conducted two regional workshops for local unions and managements covering 11 plants.
  - Conducted 15 on-site local orientation and consultation sessions.
- **Skills Enhancement**
  - Self-paced basic electronics training for electrician skills enhancement being pilot-tested (30 active employes).
- **Employe Involvement (EI) Support and Other Joint Activities**
  - Sponsorship of first national EI educational conference -- September 1982; 500 attendees.
  - EI Training Assistance Provision (EI-TAP) for local steering committees and EI facilitators for certain EI courses, seminars and workshops by outside institutions and organizations.
  - Publication of UAW-Ford EI Survey (Center Report No. 1) and The Sharonville EI Story (Center Report No. 2).
  - Development of a training film on the UAW-Ford EI process.
  - Development of an EI leadership workshop for Union and Company labor relations representatives.
  - Assistance for two local committees in joint educational orientation in formulating local pilot employment guarantee (PEG) plans.

UAW, FORD AND YOU

A National Vocational
Retraining Assistance Plan
For Certain Employes on Layoff
Funded by the
UAW-Ford Motor Company Employe
Development and Training Program

General Overview of The Plan

Ford Motor Company and the UAW are undertaking joint efforts to provide training, retraining and developmental opportunities for Ford employes represented by the UAW.

This pamphlet describes one of these efforts for employes who are on indefinite layoff—a National Vocational Retraining Assistance Plan—sponsored and administered by the UAW-Ford National Development and Training Center.

The National Vocational Retraining Assistance Plan can help certain employes on indefinite layoff who wish to pursue self-selected formal education or retraining to improve their chances for reemployment within or outside the Company.

The Plan generally pays for tuition and compulsory fees of up to $500 per year for any approved educational courses and up to $1,000 per year for courses at an accredited college. Applicants select courses and schools and seek approval of the National Center prior to enrollment.

Who Can Apply?

You must be a Ford-U.S. UAW-represented employe on layoff and you must have:

- recall rights under the current Ford-UAW Collective Bargaining Agreement;
- at least one year of Company seniority as of your last day worked for the Company;
- been on indefinite layoff for at least three months (unless the layoff is caused by a facility closing); and
- no immediate prospect of recall to work.

Are There Other Requirements?

Among other things, you must select courses and schools which are covered by the Plan, obtain approval for enrollment from the National Center, and satisfactorily complete courses in which you enroll.

What Courses Are Acceptable?

The Plan covers:

- all courses required for high school completion (or high school equivalency certificate);
- university, college, business, trade, or vocational school courses or adult education classes related to jobs for which you could be expected to qualify; and
- other courses or studies approved by the National Center.

What Schools Are Acceptable?

Acceptable schools are those accredited by recognized accrediting agencies, approved under government education or training programs, or otherwise approved by the National Center.

What Type of Assistance Is Offered?

The Plan normally pays tuition and compulsory fees for approved courses up to $500 per year. For accredited college or university courses, the maximum is $1,000 per year. (Compulsory fees are those which all students must pay to take a given course.) The type of fees which may be approved include:

- tuition or general fees charged instead of tuition;
- registration or enrollment fees;
- health service or laboratory fees.

Fees or payments for the following are *not included*:

- books or supplies;
- transportation or parking;
- meals or recreational activity;
- graduation or other expenses.

The Plan provides for payment *directly to the school* in which you enroll.

If you qualify for educational financial aid from other sources (such as Veterans Administration benefits, Trade Readjustment Allowance (TRA) benefits, grants or scholarships), the Plan would apply only to that portion of tuition and compulsory fees not covered by these other sources.

How Long Can I Receive This Assistance?

You may qualify for up to four years (or $4,000) of assistance while on layoff. This is keyed to your Company seniority as of your last day of work as follows:

Years of Company Seniority	Years of Retraining Assistance	Total Maximum Amount
1 to 5	One	$1,000
5 to 8	Two	$2,000
8 to 10	Three	$3,000
10 or More	Four	$4,000

Certain employment status changes may affect your eligibility. For example, you no longer would be covered by the Plan if you are recalled to work, lose your seniority, or accept full-time employment outside the Company that would pay wages generally comparable to those on your former job at Ford or qualify you for similar training programs provided by a new employer.

Continued eligibility also depends upon satisfactory completion of courses in which you enroll and compliance with other Plan provisions.

What Should I Do Now?

That is essentially your decision. It is up to you to start the process.

You are responsible for selecting courses and schools, obtaining information about admission requirements and fees, and making other necessary arrangements for enrollment. Most educational institutions have counseling services that can advise you about studies that you may wish to consider.

If you select a course and a school, complete the attached Plan application as far *in advance* of the school's enrollment deadline as possible and return it, using the enclosed envelope, to the:

UAW-Ford National Development
and Training Center
P.O. Box 6002
Dearborn, Michigan 48121.

The Center will consider your application carefully and notify you about its decision. Allow at least three (3) weeks for the Center to process your application. If your application is approved, an Approval Certificate will be mailed to you. This certificate will enable you to enroll in your course and have approved fees paid by the Center.

Jointly Dedicated to
Human Growth
and Understanding

Joint Governing Body

Donald F. Ephlin
Vice President
Director, National Ford
Department, UAW
Union Co-Chairman

Dan Forchione
Administrative Assistant
to Vice President
Director, National Ford
Department, UAW

Elvin C. Hendricks
Coordinator of
Special Projects
National Ford
Department, UAW

Peter J. Pestillo
Vice President
Labor Relations
Ford Motor Company
Company Co-Chairman

John E. Reese
Director,
Union Affairs Office
Ford Motor Company

Ernest J. Savoie
Director,
Labor Relations
Planning and
Employment Office
Ford Motor Company

The National Development and Training Center, established under the UAW-Ford Motor Company Employe Development and Training Program, has a Joint Governing Body. The Governing Body consists of the above Company and UAW representatives who authorize specific programs such as the National Vocational Retraining Assistance Plan.

An annual budget has been established to fund the Plan. Applications will be considered by the National Center and processed as long as budgeted funds are available.

Continuation or modification of the Plan or its various features is subject to the terms and conditions established by the Joint Governing Body which also reserves final authority for interpreting the Plan's provisions.

Issued by the UAW-Ford National
Development and Training Center

March 1983

The UAW-Ford National Vocational Retraining Assistance Plan

Application

Please Print or Type All Entries

☐ NEW ☐ RENEWAL

Section I

Name ______ (Last) ______ (First) ______ (Middle Initial) Social Security Number ______

Address ______ (Number) ______ (Street) ______ (Apt. No.) Telephone ______ (Area Code) ______ (Number)

______ (City) ______ (State) ______ (Zip) Seniority ______ (Month/Day/Year)

Plant from which laid off ______ (Name of Plant) ______ (UAW Local No.) ☐ Skilled ☐ Non-Skilled Last Day Worked ______ (Month/Day/Year)

Section II

(This section should be completed with the help of a school counselor.)

I wish to apply for the following program this term:

☐ Adult Vocational Education ☐ High School Completion or G.E.D. Program ☐ 2 Year Degree ☐ 4 Year Degree

☐ Graduate Degree ☐ Certificate Program ☐ Other Program (Please Specify) ______

Program Title ______ Term Beginning Date ______ (Month/Day/Year)

School ______ Name ______ Term Ending Date ______ (Month/Day/Year)

______ Street Address ______ City/State ______ Zip

Is this institution an accredited/approved college or school? ☐ Yes ☐ No

If yes, by what agency? ______

Please list course number(s) and title(s)	Credits	Total Course Hours	Tuition Cost*	Compulsory Fees*	
			$	$	
					$ ______ Total Cost*

*For Term or Billing period (Excluding Books, Supplies, Transportation, etc.)

Section III

Are you receiving or will you receive financial aid or benefits from other sources (such as VA, TRA, CETA, scholarship, etc.) for this course(s)? ☐ Yes ☐ No

If known, indicate source ______ and amount $ ______ for this course(s).

What portion of this amount is for tuition and compulsory fees? $ ______

Section IV

Enrollment in the above course(s)/program is for the following reason:

______

______

______

Section V

As an eligible UAW represented laid-off employee of Ford Motor Company, I apply for approval of the above course(s) under the UAW-Ford National Vocational Retraining Assistance Plan. I understand that (1) tuition assistance will be subject to conditions contained in the program, (2) I am responsible for the payment of all non-approved costs and/or fees, (3) my employment status is not affected and I am not considered an active employee of Ford Motor Company due to such training, and (4) the training is voluntary, not considered hours of work or employment and is not subject to compensation. In addition, I agree to provide whatever information may be required for the administration of the UAW-Ford National Vocational Retraining Assistance Plan and that continuance in the Plan is subject to meeting its provisions, including satisfactory course completion requirements of the educational institution for previously approved courses. I further authorize any educational institution that I may attend to release to the UAW-Ford National Development and Training Center any requested information pertinent to this Plan regarding my status at said institution, including the release of a transcript or other information as outlined in the Plan.

Applicant signature ______ Date ______

For Center use only A ☐ D ☐ R ☐

NDTC D-99 [illegible] 5/83 74 When completed, mail to: UAW-Ford National Development and Training Center, P.O. Box 6002, Dearborn, Michigan 48121

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Instructions for Completion of the Application for Enrollment in the UAW-Ford National Vocational Retraining Assistance Plan

GENERAL:

Read these instructions carefully before you fill out the application form. Print with black ink or type all requested information. Look over the application again when you're done to make sure that you included all requested information before mailing it to the National Center. (Incomplete forms will only delay action.) **BE SURE TO SIGN THE APPLICATION.**

SECTION I:

Fill in all of the information requested. If you need assistance, contact your local Union or the plant Hourly Personnel Office.

SECTION II:

This section should be completed with the help of a school counselor or official from the school or college you wish to attend. Be sure to list the course number(s) and title(s) and include tuition cost and compulsory fees for *Term* or *Billing Period* only.

SECTION III:

If you qualify for or will receive financial aid or benefits from sources other than the National Vocational Retraining Assistance Plan, you must identify the sources. The Plan will pay only that portion of tuition and compulsory fees not covered by other sources. Therefore, it is to your advantage to apply to all sources you qualify for. If you check "yes," indicate source, amount for the course(s) and what portion of this amount is for tuition and compulsory fees. (You may want to talk to the financial aid department or counselor at the school or college you wish to attend.)

FAILURE TO COMPLETELY LIST SOURCES OF OTHER FINANCIAL AID THAT YOU RECEIVE OR FOR WHICH YOU QUALIFY CAN DISQUALIFY YOU FROM TAKING PART IN THE PLAN.

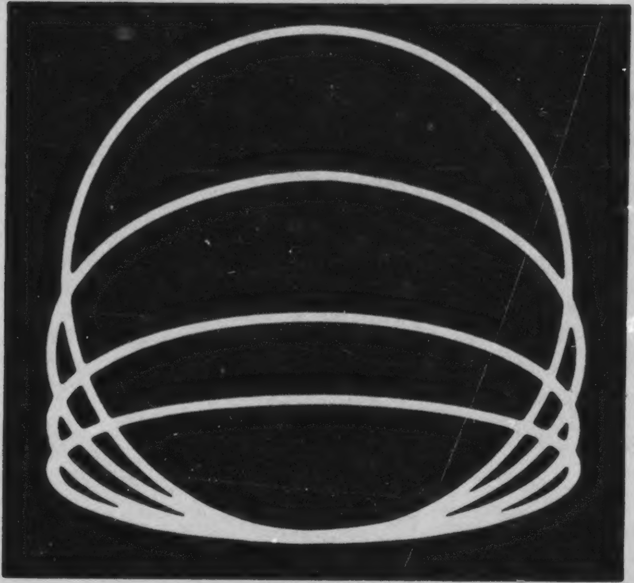
SECTION IV:

In this section, briefly tell why you feel the requested course(s) will help you and improve your chances of reemployment.

SECTION V:

READ THIS SECTION CAREFULLY—THEN *SIGN* AND *DATE* THE APPLICATION. UNSIGNED APPLICATIONS WILL *DELAY* PROCESSING.

The National Vocational Retraining Assistance Plan *pays fees directly to the school.* When your application is approved, an Approval Certificate will be mailed to you. When you present this certificate to your chosen school, you will be enrolled in the approved course(s) and your tuition and fee costs will be billed to the National Center.



UAW-Ford Employe Development and Training Program

Activity Summary

PROGRAM OBJECTIVES

The purpose of the joint Employe Development and Training Program (EDTP) is to:

a) arrange for career counseling, retraining, job search training and placement assistance for laid-off employes;

b) assist in designing and obtaining appropriate career counseling, training, retraining and personal development for active employes;

c) support local and national UAW-Ford Employe Involvement efforts and other joint activities; and

d) provide opportunities for the exchange of ideas and innovations with respect to employe development and training needs.

Program features are being developed locally and nationally along participative lines coordinated by a separate entity, the UAW-Ford National Development and Training Center, under the general direction and guidance of a joint UAW-Ford Governing Body.

PROGRAM FOCUS

Like Employe Involvement (EI), the UAW-Ford Employe Development and Training Program has its focus on the employe. The thrust of EDTP is to expand the principles of involvement to those of caring -- caring about careers, personal plans, and human progress. The Program itself is being developed and applied along the participative lines characteristic of UAW-Ford EI: local committees, employe voluntarism, local program flexibility and autonomy, and national support. Further, the EDTP extends into the community, creating working consortiums with educational, social and governmental bodies.

FUNDING

Funding for the Program, the Center and its activities is provided under the Collective Bargaining Agreement at 5 cents per hour worked, with expenditures authorized and approved by the Center's Joint Governing Body -- consisting of an equal number of Company and UAW Representatives. The co-chairmen of the Governing Body are Donald F. Ephlin, Vice President and Director-National Ford Department, International Union, UAW; and Peter J. Pestillo, Vice President, Labor Relations, Ford Motor Company.

Here are some examples of activities that have been joi

Program Activity	Description
• National Vocational Retraining Assistance Plan (NVRAP) - 750 enrollments - national scope	Prepaid tuition assistance plan for certain laid-off employes; launched August 1982
• Targeted Vocational Retraining (TVR) Projects - 4 projects to date	Special full-time technical or skills-oriented training for laid-off employes. Focus is on areas having job prospects or representing future growth markets
• Vocational Plans and Interest Surveys - 5,500 employes surveyed - 10 locations	Information gathering and computing assistance on employe career plans and interests for plant committees to use in local Program (EDTP) applications
• Career Counseling and Guidance (CCG) - 5 test locations	Assistance for active and laid-off employes in forming and achieving their personal and career goals. Contains four modules presently being field tested: self-awareness, career awareness, career decision making, and career planning

ntly developed and implemented through February, 1983:

Program Activity	Description
• Job Search Skills Training - 3 test locations	Self-directed job hunting skills training and professional job search assistance. Methodology being assessed
• Special Assistance for Plant Closings - 2 locations	On-site consultation and planning assistance. Liaison with government agencies and community resources. Comprehensive program formulation and delivery
• Career Day Conferences - 4 locations - 2,300 laid-off employes have attended	Sponsored by local committees to explain available career guidance and training services, including community and public services (Center on-site planning and assistance on request)
• Workshops and On-Site Program Orientation - 26 facilities	National Center assistance to local committees to establish a local EDTP and basic training in program elements
• Employe Involvement (EI) Support	National EI Educational Conference, September 1982 — 500 attendees Special tuition assistance for certain outside EI training courses/seminars

NATIONAL DEVELOPMENT AND TRAINING CENTER

The purpose of the UAW-Ford National Development and Training Center (NDTC) is to translate Program goals into action. The National Center is directed and guided by the Joint Governing Body. Day-to-day operations of the Center are managed by an Executive Director, with a small staff of professional and administrative support personnel, including four Program Associates, a Career Counseling and Guidance Associate, and a Job Development and Placement Associate.

The National Center coordinates and helps develop activities under the Program. The Center provides on-site assistance to local managements and unions to help them design and implement local applications.

The National Center concentrates on planning, design and coordinative functions. The Center does not to any significant degree provide education or training on its own premises but principally relies on existing community educational and counseling resources using their faculties and curricula to provide specific trraining and development programs. The Center is building a participative program delivery network linking local managements, local unions and community resources throughout the country.

The Center is headquartered on the campus of Henry Ford Community College, Dearborn.

The jointly-administered Employe Development and Training Program is a key element of the comprehensive interlocking mutual growth framework the Ford Motor Company and the UAW created in their 1982 Collective Bargaining Agreement.

Donald F. Ephlin
Union Co-Chairman
Dan Forchione
E. C. Hendricks

Peter J. Pestillo
Company Co-Chairman
John E. Reese
Ernest J. Savoie

UAW-Ford
National Development and
Training Center
P.O. Box 6002
Dearborn, Michigan 48121
Executive Director
Andrew A. Mazzara, Ph.D.

CASE STUDY 21

UAW-Ford Joint Venture

A Progress Report: The UAW-Ford Employe Development and Training Program

Case Description

UAW-Ford National
Development and Training Center
P.O. Box 6002
Dearborn, Michigan 48121
Type of Program:
Employe Training and Development
Initiated: 1982
Eligibility: Active and Laid-Off Employes

© American Productivity Center

A Program Statement

The UAW-Ford Employe Development and Training Program clearly demonstrates the creativity and responsibility that the parties brought to the bargaining table last winter. No other company and union has anything like this Program.

The Program is specifically designed to meet a broad range of employe development and training needs—and that, no doubt, is the way it will be seen by most observers.

But it is, in truth, much more than that. Above all, the Program is a joint participatory process of wide scope. It is a logical extension and application of the Employe Involvement principles which are forming new attitudes and approaches throughout Ford and the UAW.

This Program has been carefully crafted to serve the individual Ford employe. By helping employes fashion answers about themselves and their work, and by helping them get the training and education they want, Ford and the UAW are jointly contributing to making work a more rewarding and satisfying experience for individuals. Mutual growth comes only through effective people.

While the national configurations provide a framework, the heart of the Employe Development and Training Program will, like the UAW-Ford Employe Involvement process, be in jointly developed local adaptations and implementations.

Donald F. Ephlin
Vice President
Director—National Ford Department
International Union—UAW

Peter J. Pestillo
Vice President
Labor Relations
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CENTER
PRODUCTIVITY
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123 North Post Oak Lane
Houston, TX 77024

A progress report on a new joint effort

by
Ernest J. Savoie
Director, Labor Relations Planning
Ford Motor Company

——— and ———

Elvin C. Hendricks
Coordinator of Special Projects
National Ford Department
International Union—UAW

Introduction

As the nation approaches a half-century of the collective bargaining process that began flowering under the sanctions of the 1935 Wagner Act, it is unusual when any truly new feature appears on the negotiations landscape.

In 1982, Ford and the UAW introduced not just one, but several innovative worklife structures to their Agreement.[1] These were designed specifically to promote joint activities that will enhance communications, fact-finding, problem-solving, the recognition of mutual interests, operational efficiency, organizational improvement and employe development training.

To achieve the last-mentioned objective—development and training—the parties designed a program that has as yet no parallel anywhere in American industry. Officially called the UAW-Ford Employe Development and Training Program (EDTP), it was to start operation within six months of the signing of the new Contract. This progress report recounts what has been accomplished to date—both in terms of projects underway and plans that are being formulated.

A Preliminary Perspective

Two perspectives are useful for an appreciation of the intent and operation of the EDTP.

First, the EDTP is not a stand-alone creation. Rather, it is but one of several features that were crafted into a framework of interlocking mutual growth arrangements. Like the other elements of the network, it too was designed to serve the central purposes of the 1982 Agreement: job security, greater competitiveness and mutual growth. The EDTP contributes to these overall goals principally by making employes more satisfied, more effective, more versatile and more valuable.

The second perspective, which will become more evident as this progress report unfolds, is that the EDTP is as much a wide-ranging participatory process as it is a development and training program. It provides the employe, the UAW and the Company a strong voice in a variety of new ways, all of which are aimed directly at promoting the employe's well-being. To consider the EDTP simply as training would be to miss its essence.

Summary Overview

The basic documents that charter the EDTP are a February 13, 1982, Letter of Understanding, the Attachment to that Letter and a related excerpt from the 1982 Settlement Agreement which specifies the funding arrangements for the Program.[2]

This Program, unlike most others, is essentially a statement of goals and purposes. It cannot function without some flesh and blood to do the planning and tend to the administrative chores. For that reason, Ford and the UAW also created a joint planning instrument to assist in translating Program goals into reality. It is the UAW-Ford National Development and Training Center.

Separate and distinct from the Program itself, the Center is under the general direction and guidance of a Joint Governing Body consisting of an equal number of UAW and Company representatives. Day-to-day operations of the Center are managed by an Executive Director, who is assisted by a small staff of professional and support personnel. A prime mission of the

National Center will be to work with local unions and managements to develop plant-level employe development and training programs.

Funding for the Program, the Center and its activities is established under the Collective Bargaining Agreement at 5¢ per hour worked, with expenditures to be authorized and approved by the Center's Joint Governing Body.

Off and Running

In the summer of 1982, Ford's UAW-represented work force had fallen from a 1979 peak of over 200,000 to about 110,000. About 45,000 of those on layoff still had recall rights. It was not surprising, then, that the Governing Body directed that the first Program efforts be aimed at this group. Two approaches have been fashioned and are being implemented. One is a prepaid tuition assistance plan, and the other is targeted vocational retraining.

- In August, the Center mailed a brochure describing the National Vocational Retraining Assistance Plan (NVRAP) to laid-off employes with five or more years of seniority. This plan pays tuition costs for qualifying individuals so they can pursue self-chosen education and training to improve their chances for re-employment within *or* outside the Company. The mailing went to 18,000 employes. To date, nearly 3,000 laid-off employes have responded indicating an interest in using the Plan.
- The two first Targeted Vocational Retraining (TVR) projects were launched in the greater Detroit area. Similar projects are being formulated in other cities and states where there is a substantial concentration of Ford employes.
- An entirely new Career Counseling and Guidance (CCG) program for active employes (with parts of it tailored for employes on layoff) is being pilot tested at four Ford plants. When fully operational, this CCG will be the first extensive application under collective bargaining of career and personal growth counseling for represented hourly workers.[3]

These three programs—NVRAP, TVR, CCG—are the first to be initiated within the charter of the EDTP. They are worthy of more extensive review because they demonstrate how Program goals are translated into action and how local unions and managements will participate in making these programs and other programs a local reality.

National Vocational Retraining Assistance Plan (NVRAP)

The NVRAP is a nationwide tuition assistance plan for qualifying *laid-off* employes who wish to pursue further education or training. Employes choose their own courses and programs. The Plan is designed to help laid-off employes improve their chances of re-employment either within Ford—or with some other employer.

Tuition assistance in itself is not new at Ford; the Company has long had a program that gives active employes tuition assistance. What is new is that qualified *laid-off* employes can now receive such assistance.

The Plan generally covers tuition and compulsory fees up to $500 per year for approved educational courses (up to $1,000 per year for courses at an accredited college). Laid-off employes may qualify for up to four years of tuition assistance depending upon seniority.

While active employes have their tuition costs *reimbursed*, the Plan for laid-off employes provides *prepaid* tuition. This is in recognition of the fact that laid-off employes are less likely to have "up front" money for tuition. Also, the Plan for laid-off employes permits them to select virtually *any* type of vocational training or education they feel is appropriate for their situation and their goals. Unlike most other tuition *reimbursement* plans, there is no requirement that the education must be related to positions to which the employe can reasonably expect to aspire within his or her general background and experience.

The Plan for laid-off employes is funded by the national EDTP and is administered by the National Center. Employes are encouraged to meet with local educational counselors, determine the course selection of their choice, and submit proof of enrollment to the National Center. The burden of detailed administration is removed thereby from the plants and facilities.

Local unions and plant managements are encouraged, however, to assist their laid-off members/employes by actively promoting both the Plan and available course offerings. Some of the ways this can be done are by: inviting educational institutions to provide course offerings at the plant; arranging for them to come to the plant or to the union hall or to some other facility to orient employe groups, discuss course offerings, encourage attendance and offer counseling; sending congratulatory letters to course graduates; evaluating local experience to reshape or expand local offerings and approaches and to assist in future planning.

Targeted Vocational Retraining (TVR) Projects

TVR projects consist of intensive, full-time carefully selected retraining efforts. Most frequently these are of a technical nature or are otherwise designed to lead to particular occupational skill certifications for laid-off employes who because they need new skills have little immediate prospect of re-employment.

Such retraining normally involves full or half days in class, and it can be as long as 16 to 50 weeks depending on the subject matter. TVR's are approved by the Governing Body where definite job prospects can be identified by the local employment agencies after a review of particular labor markets.

Successful local TVR's are not easily established. It takes a concerted effort and careful orchestration on the part of the local unions and managements with their community, government and educational institutions. Many variables must be evaluated, including job placement prospects, educational institutions' program offerings and applicant screening in terms of interest, motivation and aptitudes. Such projects can be expensive . . . costing from $2,000 to $5,000 per participant for tuition and fees.

The first two UAW-Ford TVR projects were initiated by the National Center in order to gain hands-on experience that could be shared later with field locations. The first two TVR's involved laid-off employes from 15 plants in the southeastern Michigan area. Fifty-one laid-off employes are now enrolled in two vocational retraining programs—a 15-week Accelerated Pipe and Pressure Vessel Welding Certification program and a 30-week Tool and Die Detailer program (the latter sponsored through public funds). Both programs were designed and offered through Henry Ford Community College located in Dearborn, Michigan.

To identify laid-off employes with aptitudes for these vocational areas, the National Center secured the assistance of the Michigan Employment Security Commission (MESC) and of the Downriver Community Conference (DCC), a nonprofit business and employment resource center. After identification of some 350 prospective participants, the MESC and DCC collaborated with Henry Ford Community College in conducting aptitude testing and providing career counseling and program orientation.

In addition to directly funding selected specific UAW-Ford TVR projects, the National Center will continue to encourage counterpart projects (like the detailer program) which are available to individuals and groups through public funding.

Future TVR projects will be initiated by local unions and managements in their communities with the assistance of the National Center. Exploratory visits are being made to major Ford locations in Illinois, Ohio and Alabama. A program goal is to have a UAW-Ford TVR project in every location where there is a substantial number of Ford employes on layoff.

Career Counseling and Guidance (CCG)

Career Counseling and Guidance is the third early program being formulated by the National Center. It is designed to assist employes who are working, although there will be special applications for employes on layoff.

CCG assists employes in formulating their personal and career goals and achieving these goals through their own development. It has four main components:

- self-awareness
- career awareness
- career decision making
- career planning

Employes can pursue these four components, or any one of the four depending upon their desires. Some parts will be applied on an individual basis, and some on a group basis. To guide employes through these stages, there will be expert counseling (from in-house or local community resources), "How To" publications and resource guides. The whole CCG process boils down to encouraging employes to find and gauge their own personal strengths, interests and values—and how to use them or develop them.

The CCG model is being developed under a contract with Macomb Community College in Michigan and is being field-tested at four plants in Michigan, Tennessee and Ohio. After prove-out, it will be extended to all Ford locations that want to install it.

Beyond its obvious value as a mechanism for initiating training, CCG is an essential ingredient for increasing mobility prospects, whether for active or for laid-off employes. Considerable research experience suggests that the most successful adjustments occur when workers themselves decide which training or education they prefer or is most suitable to them and when they should participate in training or in mobility programs.

Ford

More to Come

The preceding three programs represent the first efforts and are simply illustrative of the kinds of initiatives that will be developed. They are just the surface of current activities and future plans.

Some elements that are yet to come will be national cores with local support, delivery and adaptations. Some will be entirely local. Some may be unique, crafted to handle special circumstances. Central to this development are local needs assessments, management-union-community interaction and an advanced degree of trust and commitment.

Local Responsibilities for EDTP

Local facility union and management leadership are the key to this pathbreaking participatory Program. The people at the plant level are the joint initiators and the catalyst for designing and implementing the programs that they want and need at their locations.

Their responsibilities extend beyond local adaptation of national parameters. Local suggestions, local needs assessments and local diagnoses will be the bases of a free-flow exchange between the local parties and National Center. An interactive network will create new goals and stimulate new accomplishments.

As with any attempt at improvement—including human resource improvement—there is a threshold challenge. Before program growth is possible, there must be understanding, commitment and patience. This means that before the Program will become a part of the way they do business, local managements and unions will have to focus on learning about the Program—and dedicating themselves to making it work.

Experience indicates there probably will be local gestation periods of varying lengths. Fortunately, in Ford plants the organizational dynamics of local joint efforts are not unknown. Local unions and managements already have learned how to work together successfully in establishing and supporting the UAW-Ford Employe Involvement (EI) process. This should prove a great asset for establishing a local EDTP.

The local parties will gain specific EDTP process confidence through a series of future workshops where local-union leadership and management representatives will learn Program specifics as well as "how to" aspects of establishing a local EDTP, and will participate in motivational and confidence building exercises.

Two Other Program Purposes

Counseling, training and retraining of active and of laid-off employes are the first two major missions of the EDTP. Missions number three and four are to support the UAW-Ford Employe Involvement process and to sponsor research in advanced employe development concepts and techniques.

With respect to Employe Involvement (EI), the Center takes its direction from the UAW-Ford National Joint Committee on Employment Involvement (NJCEI). In this regard the Center already has sponsored and conducted a UAW-Ford National Conference on EI that drew 500 Company and Union participants from across the country.

A variety of other EI support projects are underway or planned. The Center will develop an EI information resource and learning lab and will serve as a depository for local UAW-Ford EI information and strategies. The National Center will provide funds to assist in sponsoring the attendance of local steering committee members, local EI administrators and facilitators and similar local personnel at EI-related courses, seminars and workshops offered outside the Company.

Research and planning in advanced employe development is for the most part still "down the road." The first such project was the research work done by Macomb Community College to assure that the Career Counseling and Guidance (CCG) to be developed for Ford employes would be a state-of-the-art undertaking. Future research will be the seed for new ideas and programs to stay abreast of rapidly changing high technology and to be at the forefront of new approaches to employe satisfaction.

The Center: A New Form of Organization

With the UAW-Ford National Development and Training Center, a new form of organization is being created. A thorough analysis of the Program goals, the joint UAW-Ford Program ownership, and the National Center's responsibilities and authority, convinced Ford and the UAW that the Program required a special organizational structure—one with characteristics that would permit great flexibility, communication and coordination. Specifically, there had to be:

- Flexibility that allows the National Center's staff to work as a unit, while reporting to the Joint Company-Union Governing Body, yet with real if indirect and unstated relationships to Company or Union staff or field organizations.

- Communications and performance on four or five levels to simultaneously encourage input/feedback of ideas and data from these organizations.
- Coordination that quickly enhances intra/inter relationships to "get the job done," including working with government, educational and social organizations in a series of adhoc "consortiums."

The organization is still taking shape. Most of the staff is just recently appointed, yet the system has already been tested through the development of NVRAP, the TVR's and CCG. The Center itself will be run internally on participative principles. Is this the proper structure to promote the Program's desired growth, span its various activities and mobilize the appropriate organizations to meet targets and timetables? The final test will be its performance. Such an evaluation is provided for in the Program.

New Ground

The UAW-Ford Employe Development and Training Program is new ground in collective bargaining. It is new in terms of the subjects and purposes it incorporates; in its structures and responsibilities; in its focus on individual choice; in local voluntary joint efforts and the ability to tailor; in its funding and flexibility; in its outreach into the community.

The Governing Body itself has a decidedly "new" flavor to it. With counsel from the "field" and from whatever advisory committees it establishes, it can exercise considerable judgment within the general parameters of its charter. Unlike most other programs and bargained joint boards, the Governing Body can establish specific plans and programs, modify them, abolish them and reallocate funds from one approach to another depending on need and circumstance. It can make exceptions and interpretations and need not be bound by old and inapplicable provisions. The Joint Governing Body is a living entity, with living powers to foster a creative joint venture intended to benefit employes, the Union and the Company.

There will also be new ground within each specific element. This, in fact, has already occurred. All three of the programs now in place (and discussed earlier in this report) contain concepts or features that are not to be found in any other industrial setting. Indeed, none of the three programs was even stipulated as such in the negotiations' Letter of Understanding that established the EDTP. They were *jointly* fashioned *after* the negotiations; *after* a review of problems and opportunities; *within* a general fund with a *variety of needs* and constituencies; *without* imposed *deadlines;* with *self-chosen* targets; and with full up-front recognition that not everyone in Ford management or in the UAW could be fully satisfied.

As there is an enlarging spectrum of activities, programs and approaches, still more new ground will be traveled. As with Employe Involvement, EDTP will generate a surrounding atmosphere of trust and caring. Employes, with new-generation attitudes and goals, will experience more and more the sense that their Company and their Union are working jointly to promote their personal growth. The EDTP—if it wins full commitment and if it is sincerely and energetically nurtured—can be an important worklife structure.

It can—in content, style and practice—make a powerful contribution to the full range of participatory goals—everything from product and quality competitiveness to better management-union climates, to improved work satisfaction. That is why it was created.

Footnotes

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[1] For a discussion of these structures and of the general character of the Ford-UAW Agreement see: Savoie, Ernest J. (foreword by Donald F. Ephlin) "The New Ford-UAW Agreement: Its Work Life Aspects," *The Work Life Review,* Vol. 1, Issue 1, published by the Michigan Quality of Work Life Council.

[2] These basic documents and other EDTP materials may be obtained by writing to the UAW-Ford National Development and Training Center, P.o. Box 6002, Dearborn, Michigan 48121.

[3] Montana, Patrick J. and Margaret V. Higginson, Career *Life Planning for Americans,* AMACOM, 1978.

Mr. GORE. Thank you. That is fascinating, and we will have a bunch of questions after the panel is over with.

Our next witness is Francis Tuttle, director of the Oklahoma State Department of Vocational and Technical Education in Stillwater, Okla.

Mr. Tuttle, we are pleased to have you here. Your State has a reputation of being one of the two best in the country where this effort is concerned, and we are interested in hearing from you.

Please proceed.

[The biographical sketch of Mr. Tuttle follows:]

PERSONAL DATA SHEET

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PERSONAL: (Wife) Vivian
Instructor, Stillwater Middle School

EDUCATION:
B.S. Degree, Oklahoma A&M College
M. Ed. Degree, Oklahoma University
Professional Certificate in School Administration, Oklahoma University
Ed.D. in School Administration, Oklahoma University

WORK EXPERIENCE:

Vocational instructor, Kiowa County, 1942-44 and 1946-1951
Army Service, 1944-1946
Superintendent of Schools, Gotebo, Oklahoma, 1951-55
Superintendent of Schools, Holdenville, Oklahoma, 1955-62
Superintendent of Schools and Junior College, Muskogee, Oklahoma, 1962-64
State Coordinator, Area Vocational-Technical Schools, State Department of Vocational and Technical Education, Stillwater, Oklahoma, 1964-67
State Director, State Department of Vocational and Technical Education, Stillwater, Oklahoma, 7-1-67 to present

CAREER HIGHLIGHTS:

Oklahoma State University Outstanding Education Award, 1972
Outstanding Service Award from American Vocational Association, 1976
National Association of State Directors of Vocational Education President, 1975-76
American Vocational Association Outstanding Service Citation, 1976
Oklahoma Association of School Administrators President, 1960-61
Oklahoma University Outstanding Education Award, 1978
Oklahoma Public Administrator of the Year, 1980
Who's Who in American Vocational Education, 1980
Henry G. Bennett Distinguished Service Award, Oklahoma State University, 1982

CONSULTANT:

Member of the U.S. team that evaluated the system of public education in Sweden for the Swedish Ministry of Education, 1963
Consultant on administration and supervision of vocational education in Thailand, 1970
Represented U.S. State Department on a U.S.S.R. exchange on vocational education in Russia, 1971
Consultant to Bureau of Adult, Vocational, and Technical Education, 1971
Special consultant to Department of Commerce, Economic Development Administration, 1972
Consultant to six European countries, 1976
People-to-People Oklahoma Educators' Tour of People's Republic of China, 1981
Advisory Committee for the National Center for Research in Vocational Education, Columbus, Ohio
Business Roundtable of the U.S. Construction Industry
Advisory Committee on Vocational Education for Economic Development, American Vocational Association
National Academy of Sciences Committee on Vocational Education and Economic Development in Depressed Areas, 1982-83

MEMBERSHIPS:

Exchange Club of Stillwater, Stillwater Chamber of Commerce, Oklahoma State Chamber of Commerce, Oklahoma Board of Private Schools, Oklahoma Accrediting Agency, Oklahoma Vocational Association, Oklahoma Association of School Administrators, Oklahoma Council of Local Administrators, Oklahoma Association of School Business Officials, Cooperative Council for Oklahoma School Administartion, Council of Vocational Educators, American Vocational Association, American Society for Public Administration, the National Association of State Directors of Vocational Education, and the National Vocational Education Professional Development Consortium.

PUBLICATIONS:

"Guidance--In a Small High School." *National Education Association Journal and Guidance*--Special Journal Feature, 1959
"Muskogee's Foreign Language Program." *The Oklahoma Teacher*, 1963
"Federal Aid to Education in Oklahoma." *The Oklahoma Parent-Teacher*, 1965
"The Tremendous Need." *The Oklahoma Teacher*, 1965
Final Report on Phase I of Summer Institute to Train Data Processing Teachers for the New Oklahoma Statewide Computer Science System. Oklahoma State Board for Vocational Education, Division of Technical Education, Office of Education Grant, 1966
Final Report on Phase II of Summer Institute to Train Data Processing Teachers for the New Oklahoma Statewide Computer Science System. Oklahoma State Board for Vocational Education, Division of Technical Education, Office of Education Grant, 1969
"OTIS Matches Manpower Supply and Demand." (With Paul V. Braden and John C. Shearer) *American Vocational Journal*, 1971
"Computer Education in Oklahoma." *American Vocational Journal*, 1971
"Career Education." *The Oklahoma School Administrator*, 1972
Accountability as Part of Professional Development. (With Leon Lessinger) Advocacy on Issues, National Resource Panel, Vocational Professional Development, 1974
"The Impact of Vocational and Technical Education on Manpower and Economic Development." (With Arch B. Alexander) *Economic Development Research Report*, U.S. Department of Commerce, 1976
"Revitalizing Communities Through Industry Services Programs," *Critical Issues Series, No. 2*, American Vocational Association, 1979
"Role and Responsibility of Vocational Education in Economic Development and Productivity," a position paper of the National Association of State Directors of Vocational Education, 1981

Mr. TUTTLE. Thank you, Chairman Gore, and members of the committee.

I have prepared my comments. I am not sure, as I listen to this, that I prepared them in the right direction, so I am going to deviate just a little bit and tell you some of the things that we are doing and some of the things that I perceive that may get at the problem.

First of all, very quickly, I might tell you that our State is not too much different from many of the other States in terms of how it is organized. We do have a separate State board for vocational education. On that board are primarily CEO's, executive officers, plant managers. People of this type, generally, serve on that board.

Our delivery system, of course, we have vocational education in the high schools. We also—our main thrust is through 39 vocational and technical school districts, what are large taxing districts that involve most areas of the State and then our junior college programs.

We have a law in our State that separates what the junior colleges do and what the vocational centers do, and it has been a very good one because it keeps us from duplicating and competing. The junior colleges go into the technologies; the vocational centers do the skilled training and sort of the technician area, which is an intermediate, I think, below the technology.

We do some things a little bit different. We have a special emphasis toward industry. This emphasis was established back in about 1968 by the late Senator Bartlett, who at that time was Governor of our State, and the plans that he developed at that time was that the vocational training ought to be tied closely and responsive to industry in our State.

Since that time, in talking about—it was mentioned earlier by one of the people of the quick-start training programs, we have that component and it, since that time, has trained for over 400 new industries that have located in our State.

That was, developing that effort, once we got it established and got the means for doing it, it was a piece of cake because when you have a new industry coming in and you determine exactly what the skill levels of the people it is going to employ and you have the staff to set that up and you have a bank of equipment that you can draw on to set up the training programs, the rest of it is relatively easy. That program has been very successful.

With the economic turndown, we have used many of the funds that we are using there into a program that we call our existing industry training programs which takes care of those industries that are changing over to the more technical equipment and reindustrializing, which requires new training for the workers.

So we had the appropriated funds to do that, and that program is our largest effort right now.

One of the things that we do, and Pat Choate mentioned this, is that we have a series of what we call industrial coordinators. There are one or more assigned to each of the vocational districts in our State. Their job is to spend full time working with the industry, getting them and the school together in terms of what the needs of those industries are.

If it is a large one, many times special classes are set up directly for that industry. If they are smaller, he groups them together into similar skills and set-up training programs.

We make a very concentrated effort toward upgrade programs for people who are already employed. One of our most recent activities has been to set up a productivity consortium. That consortium is sponsored by the Governor's office, the State chamber of commerce, our Department of Economic Development, and our agency.

We have a—I think a very-high level management team that is determining what the efforts of this productivity consortium does. It primarily resulted from a realization that if Oklahoma's industries were going to stay in business, and if they were going to make any growth at all, then they had to be able to be more productive than most of the industries.

If we could do something to help them become productive, it would mean that they would grow and more jobs would be created. So we spent a considerable amount of time and effort in training a cadre of people in management systems and in companies all over the United States that had successful productivity programs.

Most all of those management systems relate to employee involvement-type management and that program has been very well received. We pointed toward mostly the small- and medium-sized businesses and industries. We do not rule out the larger ones, but many of them, most of those, can hire their own productivity people and do that.

But what it has done, it has literally brought vocational education into the executive offices of our industry in the State. As much as we think that we are doing a good job in our State, and that everybody knows about us, continually when we get into that CEO, he said, I did not know you were doing that.

What this effort has done, as it has involved the top-level management in these companies, is make them recognize what is available and how they could use that in their industry for better training their people. It has worked quite well.

All this is hooked together with a very comprehensive curriculum development program because that is an ongoing, ever-changing thing. As technology changes, that curriculum has to be adjusted. It is pretty unreasonable to expect every individual school or institution to have the capability to redevelop all of the curriculum that needs to be redeveloped and updated.

What we are finding that is happening in terms of the new technologies, of course, is many of the things that have already been related to, but getting down to specifics, in terms of what it means in terms of training, it means that the people that generally are going to work in the larger areas of new technologies have to be cross-trained between a number of what used to be specific technologies.

We have categorized those primarily into five areas: electricity, electronics, hydraulics, pneumatics, and mechanical. Even your Xerox machine employs all of those areas, and somebody that is coming out to repair needs to have some understanding of all of those or he probably is not going to repair it unless it is something that fits right into what he knows about.

The next thing that we determined in regard to this, that there is a body of common knowledge that all of these areas have to have if you are going to progress in it. In the area of physics, applied physics, I might say, in the area of mathematics and some sciences, we have attempted to identify those.

Now the people that are going into our technology training go through this body of training of physics concepts, the mathematics that you have to work in any of these areas, and then the last part of their training is a more specific kind of training into any one of the areas where employment is greatest or their interest lies.

We believe that that is going in the right direction. I refer you to the applied physics concept that was developed by the Center for Occupational Research and Development out of Texas. We have used that and believe it. We have adjusted it to some extent.

My comment, because I hear so much about we have got to increase the math and science in our public schools, I would like to caution in terms of our experience that just adding another year of science or another year of math at the high school level is not going to accomplish that. Do not get trapped into that old saying that you just fund from Federal funds another science teacher, another math teacher in the public school and that is going to solve the problem. It is not going to solve the problem.

Most of the schools already offer higher math courses and science courses; if they are large enough, they certainly do. The problem is below that. The students that are coming into our high schools, if they do not have math concepts and can read at that point, adding another science or math course is not going to solve the problem.

We are finding for our students that come into vocational education, we have to go back. We have to teach reading and we have to teach them math, but we try to do it in a manner that captures their interest. That is why I use the term "applied," vocational educators know what we are talking about in terms of "applied" concepts.

It is more than just offering physics 101, which does not relate to much of anything, except some generalities. At least that was my experience when I took it, and many others.

I would like to say that if we are going to gear this country up for retraining, I think there is some things that we have to relate to. One of the advantages, I think, of our vocational program in Oklahoma is that we have some flexibility. We had some good foresight by Governor Bartlett and succeeding Governors and members of the legislature which gives us some flexibility.

When a new need arises, and if it arises in your school, we have the ability to come in and help you fund that because the problem with education throughout this country, most of the funding is tied to a teacher, a course, something that is in concrete, and if some new thrust comes along, they cannot relate to that unless they wait a year and go to the legislature and plead their case.

But States or the Federal Government or somebody is going to have to provide some flexibility in vocational education so that that can occur.

Pat Choate related to equipment needs. Certainly that is one of the main areas. Our State, our legislature presently appropriates $3 million, nothing for—except for the upgrade of equipment in our training programs each year. That was after many more millions of dollars for the initial outlay of equipment.

That does not sound like a terribly large amount of money, but we are a rather small State and that is significant in our State.

I think that the rigidity of funding is a major problem as far as vocational education is concerned. In regard to dislocated workers, I think that models like what was described here by both of these gentlemen who preceded me, are answers in that they can be done. That we have to develop our retraining based on whatever skills that worker has, but give them those skills that they have to have to go to work. But you have to know what you are training them for.

I have had many people talk to me, how are you going to retrain the automobile industry's workers out of Detroit in environs in Oklahoma. Well, hell, we are not going to retrain them in Oklahoma. We will retrain them if they come to Oklahoma and present themselves for a job, but neither is Detroit going to train them to send them to Oklahoma or Arkansas or Alabama or wherever.

Some method of helping States in terms of retraining displaced workers, in my opinion, is going to have to come about because States will not put out the capital assets. Look at it realistically. As long as there are people in Oklahoma who do not have a job, we are not going to be very interested in retraining Detroit's unemployed. We are going to put all of our efforts into training and retraining the unemployed in Oklahoma.

Presently, we have an unemployment rate in our State of something a little over 7 percent. I dare say 2 to 3 percent of those are people who have recently come to our State because we were in a cycle of very high employment and low unemployment rates.

Now, with those, and the economic downturn, our unemployment rate is going up, and we are facing some of the same kinds of problems that all other States are.

One of the things that I would like to mention that I feel so very strongly about, and that is, we have got to reinvent and revise and remake the apprenticeship program. The apprenticeship program is still the best way to train people for many of the jobs that are out there. But I believe that it has to be completely redone and revised.

It has got to be competency based, instead of time based. It has got to be set up, or rather it can be offered nonunion as well as union situations. Companies are going to have to support the apprenticeship program. Schools are going to have to support it. There is a much better way to train apprentices than we are doing now. Where it is being done in specific programs, it is the best way to really get at the training problem.

Something has been mentioned here about job banks. I do not have a terrible lot of confidence that you will ever be able to set up a jobs bank. My problem with it, and I have been involved—in our State, we developed a program back before this kind of thing was done, about 12, 13 years ago, and we did it by doing a saturation survey of every manufacturing industry in our State in terms of what their needs presently were, what they forecast their needs were going to be, then we plowed in what we were supplying and the difference was what we did our planning for.

We have continued to follow that particular plan. The problem with a jobs bank is not with the system, it is with people, getting people to accurately forecast. They are unwilling because they do not know for sure. We will have so many jobs provided we get this contract and this kind of thing. But if we do not, we will not. We may be laying off some people. It is that kind of thing that is awfully difficult to plow into a jobs bank kind of situation.

I think the best thing that we have found in our State is that we run our own. Now, that takes care of the people in our State and our planning for what kind of training that we need to do, but we could trade that kind of information with other States, or plow that into a national system.

We do our best job with those industrial coordinators, going out and talking, and becoming very close and bulding some confidence level between those people and the industries that they serve. They tell them what they are planning. But you send out a survey and they will not answer it. Or if they do, they are going to be very conservative about it and many times, they will not even bother to do it.

Let me give you an example when I said it was people. Our legislature passed a law in our State because they were concerned about dropouts in our public school system. That law said that every dropout had to be reported to me as the Director of Vocational Education so that we could try to contact those people and get them into some kind of training program and try to save them.

You know, even our schools would not report them. Only about 40 percent success in getting them to accurately report those dropouts. Well, people in industry are no different than the educators. It is very difficult to get them to do it.

One other thing that I do want to suggest to your thinking. That is, requiring training as a basis for drawing unemployment insurance. One of the biggest problems that the JTPA, Job Training Partnership Act, is going to have is how are people going to live while they are getting the training?

If we use the requirement for unemployment insurance that if they draw it, they have got to be retraining or they do not draw it. Think about it.

I would also like to say that public service employment jobs—I am not sure that you are going to consider it, but I continue to hear it talked about. I note that there are bills being introduced, but if you do that, why not put that into training of unemployed people?

It is going to accomplish the same thing, plus look at the value you get. You are getting at this problem of retraining. If you put them with a public agency as soon as the funds run out, you know, no benefit, no lasting benefit. Think about it.

Also, I encourage you to think about something that we say down in Oklahoma, we say that fads come from the top down and innovations from the bottom up.

Thank you.

[The prepared statement of Mr. Tuttle follows:]

Statement by

Francis Tuttle
State Director
Oklahoma State Department of Vocational and Technical Education
Stillwater, Oklahoma

Presented to

The United States House of Representatives
Subcommittee on Investigations and Oversight
of the
Committee on Science and Technology

Introduction

Thank you, Chairman Gore and members of this subcommittee, for providing me this opportunity to appear before you and to address this committee on the impacts of automation and high technology as it relates to employment. My name is Francis Tuttle and I am the State Director of the Oklahoma State Department of Vocational and Technical Education. Today in my testimony, I will address vocational and technical education's role in the marketplace of preparing individuals for employment and retraining the unskilled workers of today as the work relates to high technology and automation.

The key points I hope to make today are that vocational and technical education training does make a difference and that our graduates properly trained are employable and competitive in the marketplace.

Since the inception of the Smith-Hughes Act of 1917, vocational and technical education has had the responsibility of preparing individuals for job-ready work and preparing individuals in the work force with an avenue of upgraded training.

In the early days of vocational and technical training our responsibilities were related to preparing individuals for farm-related occupations that basically required simple functions and manual skills. With the passage of later legislation vocational and technical education responsibilities changed in order for our programs to be more responsive to the needs of business and industry.

Today as I testify before you, I wish I could say that vocational and technical education training programs throughout the United States agree on the same principles and concepts and uniformly approach delivery of training in the same manner, but you and I know that this is not the case and it will not be the case in years to come. This as a fact allows me to address my remarks centered around a theme and a state I know best; that being the delivery of vocational-technical training in Oklahoma.

My vocational and technical training concepts and commitments go back more years than I wish to admit. I am a graduate of a vocational training program. When I made a decision to become a vocational educator, I made a commitment to myself that I wanted education to become more responsive to the needs of the people desiring to be trained and at the same time conduct training programs that meet the needs of business and industry. I sincerely believe that we have made an attempt to accomplish and practice this in Oklahoma.

Education in Oklahoma is separated into three major delivery systems: (1) elementary and secondary education; (2) vocational and technical education; and (3) junior colleges and four-year institutions of higher education. We do not claim that this system is unique, but we do believe that the system works and we are happy to report that vocational and technical education training programs are a part of all three systems.

Mr. Chairman, allow me to expand upon each of these three systems.

1. Elementary and secondary education covers grades K through 12 with a vocational and technical education component at grades 9 through 12. Basically vocational agriculture and home economics programs are conducted in grades 9 and 12 with the other areas such as DE/Marketing, Business and Office, Health Occupations, and Trade and Industrial

programs being offered at grades 11 and 12. These types of programs are offered in over 400 school districts reaching a total enrollment of almost 60,000 secondary students.

2. Vocational and technical education schools--With the passage of the 1963 amendments for vocational-technical education, area vocational and technical schools were created. These schools cover a certain geographic region of the state and serve 11th and 12th grade students along with part-time and full-time adults during the daytime programs and serve part-time adults during the evening hours. These schools serve as an extension of the comprehensive secondary schools. Every effort is made to avoid duplication of programs and to develop programs in the AVTS that are highly technical and more expensive to operate. Presently we are operating 533 programs reaching a total of over 62,000 individuals. The AVTS network consists of 24 districts with 39 campuses. The training programs in these institutions for part-time and full-time adults are open-entry, open-exit. For additional information regarding the AVTS, refer to Appendix A.

3. Junior colleges and four-year institutions--Oklahoma is fortunate to have 14 junior colleges, 1 technical institution, 1 regional post-secondary vocational-technical school, and 13 four-year institutions. I would specifically like to point out that our post-secondary regional training school is well known throughout the United States. This institution is referred to as Okmulgee State Tech and is located at Okmulgee, Oklahoma. The training programs in this school have 6 tri-semesters with an average yearly enrollment of 3,000 students.

The programs I have just described are what we refer to as traditional programs. These type programs have been successful in the past and we still expect these programs to be successful in the future. Our statewide overall placement in school year 1980-81 was 57% program completers with another 24% continuing some type of formalized education. In 1968 a decision was made to develop an alternative vocational-technical delivery system in order to do a better job of meeting the demands of our industries. During this span of time, Oklahoma industries switched from a primarily agriculture, petroleum and service industry to more of a manufacturing state. The existing training programs could not serve this demand for a variety of reasons, particularly because of cost!

Many of the industries relocating in Oklahoma required highly technical specialized training and the training required the use of highly specialized tools and equipment. This being the case, our state board for vocational and technical education approved a plan for extending services to the field from our state office. Several divisions were established at the department staffed with competent people. These divisions were directed to work directly with industries in cooperation with a vocational school to develop a training program to meet the needs of each industry. This is what we refer to as custom-made training. These divisions are referred to as:

1. Training for Industry Programs (TIP) has the responsibility of developing "tailor made" training programs at little or no cost to new industries locating a plant within Oklahoma. This type of training is designed to provide an effective "start-up" workforce for new industry or to expanding industries. Such

training programs are conducted in the plants, in area vocational and technical schools, or leased facilities.

For the past fourteen (14) years a total of 447 specific training projects were conducted and reached 32,646 individuals at a cost to the state of Oklahoma of $4,625,629.54. The average cost was $147.70 per completer, making the training program very cost-effective.

2. Business/Industrial Training Services (BITS) has the responsibility of providing funds and services for short-term training programs. Services provided include seminar planning, identification of speakers, instructional materials and audio-visual support, development of promotional and recruitment strategies and designing tailor-made training programs for business and industry. Primarily these training programs are geared to an individual desiring to learn a new trade or an individual desiring to upgrade a trade. Many training programs are offered yearly that relate to management principles and techniques as well as information related to interpersonal development and work habits. During the past two years, a new training thrust was started. This is referred to as Existing Industry Training Programs. Many of Oklahoma's industries were at the stage that new technologies, processes, and products had to be developed and implemented.

The training programs are conducted by area vocational and technical schools using a training agreement. This agreement identifies the specific aspect of the training program and also identifies the responsibilities of the school as well as the industry.

In 1981-82 these types of training programs reached over 63,000 individuals.

3. Productivity--In order for Oklahoma business and industries to be productive and compete in the marketplace, our workforce had to be productive. With the knowledge of falling productivity in America and the intimidation and threats arising from the challenge of increased productivity in Japan and Western Europe, vocational and technical education searched for a way to make a unique contribution in this area. These factors were the springboard for creating the Oklahoma Productivity Division. The mission is to provide a management development and training consultant service to Oklahoma businesses and industries for the purpose of enhancing employee productivity and quality of worklife. This division has developed and implemented a comprehensive program designed to gain commitment from top management to improve productivity through employee involvement in order to bring about a lasting and positive change in worker performance.

   The acceptance of this training program has been great. From a a span of time from July 1, 1981, to June 30, 1982, a total of 156 managers were trained from six (6) large industries.

   The total estimated annual savings resulting from resource management training programs conducted was $1,400,847.00. This resulted in an annualized saving per trained employee of $8,979.00.

For additional information regarding these special types of training programs, refer to Appendix B.

The strength of any training program depends upon how well the completers of the program are competitive in the labor market. The curriculum must address the occupations for which training is being offered and the curriculum should be flexible to meet the needs of the leavers without destroying or alternating the needs of business and industry. If business and industry hires our graduates, then they must have input into the curriculum offering. Development of curriculum and instructional materials is a complicated, time-consuming and expensive task and each vocational training program and/or school should not be required to undertake this process single-handed. In 1970, as a department, we developed a comprehensive plan for developing instructional materials. Our curriculum staff works in conjunction with business and industry to develop the necessary materials. The materials are competency-based and are developed using a systematic approach.

Many states have adopted our materials as well as business and industry training programs. During the past several years, we have developed materials for the following groups:

1. Associated General Contractors of America
2. Tile Council of America
3. Oklahoma Association of Rural Electric Cooperatives

By using a standardized curriculum, our programs are more compatible to the needs of our business and industry. Today our training programs are competency-based instead of time-based. The traditional clock-hour programs did not work because all students do not learn at the same level. By the programs being competency-based, individuals can complete a training program at alternative times and at different levels of proficiency. Workers can be grouped into three levels of employment:

1. Helper
2. Technician
3. Technologist

Principally, the first two levels have belonged to vocational and technical education. These same two levels belong to us today and will be a part of our programs in the future along with responsibility of the level I refer to as the technologist.

As a professional vocational and technical educator, I recognize that automation and high technology have caused vocational programs to change. The decline in the productivity of this nation leaves little doubt that in order for the United States to compete in the world market and to maintain its dominant position, change must come about. Business and industry are already beginning to technologically update or to completely restructure their production techniques. Traditionally education programs have reacted to change and always played "catch-up" instead of being on the cutting edge of change. Today I do believe we are on that cutting edge of change and as educators we are making a concentrated effort to change our programs as industries are changing their operations.

Mr. Chairman, I searched long and hard to develop a comprehensive definition of the meaning of high technology. Several individuals have made such attempts and each time the definition becomes ambiguous and lacks meaning.

First let me state that high technology is today a part of all existing training programs. It simply means that today's workers and the workers of tomorrow must be able to perform tasks as the tasks relate to the technology. For example, a tire repairer used to balance car wheels using a mirror; today they are using tire balancing machines that are computerized.

The technology is such today that the technician must be able to do more than a manual repetitive task. The technician must be able to comprehend the cognitive (knowledge) and be able to process the information as it relates to the skill performance. When you think of high technology, you think of computers. That is one part of high technology that most people will agree on.

Instead of providing you with a definition of high technology, allow me to identify some characteristics of high technology.

1. Broad knowledge base
2. Heavy involvement with computers
3. Rapidly changing technical content
4. Systems-oriented emphasis
5. Basic understanding
6. Employee flexibility

Probably the greatest characteristic facing us today is broad knowledge base and systems-oriented emphasis. Allow me to expand on these two characteristics. Broad knowledge base involves a strong application of math, physics and chemistry which has not typically been a part of the vocational curriculum in the past, but today either a person brings these competencies to the training program or they are learned in the training program. Teaching pure math and physics will not work; it must be taught in such a manner that it is applied to the technology.

Traditionally vocational and technical education training programs have addressed single concepts and systems and in no way were the systems integrated. The technician who works with high technology equipment and systems must have a broad working background in five major systems: (1) Industrial Electricity; (2) Industrial Electronics; (3) Hydraulics; (4) Pneumatics; and (5) Mechanical. With the coming of automation comes robotics. A robot is a piece of equipment assembled from a mixture of the five integrated systems. This technician must comprehend each system as a separate system but be able to relate individual systems into an integrated network.

Future Directions--The need for persons trained in many of the traditional skills will continue as transitions are taking place. To assume that there will be a tremendously large number of training programs surfacing with new names is a fallacy. What must happen is that the content of the existing curricula for training programs must be changed to reflect the new technological knowledge that is required by business and industry.

Vocational and technical education has always been a prime supplier of our industries' workforce and we can be competitive in training today's and tomorrow's workforce, but you as decision-makers in Congress and we as vocational educators in the states must work together as partners. The federal government has always had an instrumental role in reshaping and restructuring educational and training systems. Our efforts must be united and we need to be concerned with the total population of people desiring to be trained or the retraining of unskilled workers.

Some of this can be contributed directly to our economic condition, but we must also accept the fact that much of our unemployment can be contributed to technology. A large portion of our unemployed workers are classified as deskilled. Stated simply, they cannot compete in a skilled area because they did not upgrade themselves and they let technology pass them.

If vocational-technical education is to be competitive in the future, some changes are going to have to be made. Some of the changes can be implemented somewhat quickly and without excessive cost, but some will require time and the cost could be somewhat expensive. I list these as possibilities for changes as I see them from my state.

1. Curriculum modification--Vocational and technical education decision-makers are going to have to develop a close linkage with business and industry in regard to developing the appropriate curriculum offering. Industrial groups must agree upfront on minimum standards for the curriculum and be able to do better forecasting of the worker needs. Educators are going to have to streamline the educational process to allow for different entry and exit points. All training programs will have to be competency-based and the instructional materials will have to be modular and in most cases should be individualized. A mechanism for keeping the content of the curriculum current will have to be developed. All individuals completing the curriculum should be evaluated and some type of written documentation must be given to graduates.

   Today's workers must have a strong application of math, science and communication skills. Math, science and communication skills have always been important but are more important today. Some educators believe that these skills can be addressed by simply requiring additional courses in the school curriculum. Taking another math course will not necessarily make the student competent in math. Most math is taught as theoretical math and not as applied math.

Math tasks belong to a variety of occupations and should be taught as an integrated concept and not in isolation. The same holds true for the areas of science and communication.

2. Teacher upgrade training--Many of today's vocational and technical education instructors have got caught in the technology gap. States will be required to develop a retooling effort to offer technical update training programs. In some instances industrial-sponsored training will be essential.
3. Facility and equipment modification--Probably one of the greatest weaknesses we have in education today is the outdated and obsolete shops and laboratories. Many facilities were built without thinking what the curriculum was going to be and how many students were to be served. Redesigning facilities could be one of the most expensive tasks we face in education. Many researchers report that 40% of the equipment we are training on today in our vocational programs is outdated and no longer being used in the industry.
4. Restructuring alternative delivery systems--One of the most cost-effective measures we could undertake is to develop alternative delivery systems for education. I, like you, recognize this as being a social issue and change will be difficult.

What is magic about a twelve (12) year curriculum? What is magic about a two (2) to three (3) year curriculum for vocational education? What types of articulation system do we have between and among the different levels of education? What is

> the magic of holding a nine (9) month school year and allowing three (3) months off in the summer? What is the magic of conducting school on a six (6) hour day? Probably you could not find any two answers the same, but probably one response would surface and be consistent among responders; that being tradition.

Each level of education has two (2) basic responsibilities: prepare people for work and/or prepare people for continuing education.

Summary

In summary we can report that the dollars we have invested in vocational education have been a good investment. We can point to research that documents that vocational and technical training programs have made a difference. We also must recognize that changes need to be made and that some of these changes will require time and cost dollars. We must not lose sight of our mission and develop an attitude that automation and high technology are going to completely revamp our training system. To state that the skills currently being taught in our programs today will not be needed in the next decade would be a misstatement of the fact.

History reveals that vocational education has always risen to meet the needs of business and industry. In the years ahead as well as today, vocational and technical education will be called upon to train workers to increase productivity resulting from the revitalization of this nation's business and industries.

Vocational education will need to approach the future with the realization that new approaches and new training programs are essential to train tomorrow's workforce in a highly technical work place.

OKLAHOMA'S
INDUSTRY SPECIFIC VOCATIONAL TRAINING:
Process and Progress

Prepared by the Oklahoma State Department of Vocational and Technical Education
as a Report to the Vocational Education Sub-Committee,
Oklahoma House of Representatives Committee on Education

March 8, 1983

OKLAHOMA'S
INDUSTRY SPECIFIC VOCATIONAL TRAINING:
Process and Progress

Beginning January 1, 1968, Oklahoma added a new phase of operation—that of providing industry specific training.

By July 1, 1982, industry specific training was being provided through three major divisions of Vo-Tech: Training for Industry Programs, formerly known as Special Schools; Business/Industrial Training Services; and Productivity. Industry specific training can best be defined as that training which is directed toward providing those skills which are specific to a function which a worker in a particular plant or industrial operation must have to be an effective, productive worker. Industry specific training does not rely heavily on theory or conceptualization but is based on an analysis of the actual operations workers are expected to perform. In vocational education this is known as the analytical method of training, training the individual to do the operations they will be expected to do on the assembly line or within a specific plant.

Initial impetus for vo-tech's entry into the field of industry specific training was recommendations from the Study of Vocational Education by Ling-Tempco-Vaught (LTV) completed during the summer of 1967. The so-called LTV Study was commissioned by the Oklahoma Legislature and the then Governor Dewey Bartlett. The LTV Study recommended that Oklahoma Vo-Tech initiate a program of training geared to active support of the state's economic and industrial development efforts. The study proposed a Special Schools for Industry program patterned and named after an existing program in South Carolina. The specific purpose of the

Special Schools program was to encourage new industry to locate in Oklahoma or existing Oklahoma industry to expand, thus creating more and better jobs for Oklahomans and improving the state's economics base.

SPECIAL SCHOOLS
TIP: TRAINING FOR INDUSTRY PROGRAMS

On January 1, 1968, this program became a reality in the state of Oklahoma. Word was passed along through various facets of the media and by industrial recruiters that Oklahoma was now providing an incentive to industries to move to Oklahoma or to expand in the state by providing "tailor made" training programs at little or no cost to the industry. These Special Schools provided orientation for potential employees to the company, a training program designed to provide an effective "start up" work force for the new industry or the expanding industry, training aids and curriculum manuals to facilitate the program of instruction, facilities within which to do the training, equipment on which to do the training, and instructors (often hired from the company) to present the instruction. Where effective instruction could not be provided in any other way, the Special Schools would provide "on-the-job training" for workers whereby their production work would be closely monitored and individualized instruction provided as needed. Special Schools generally provides instructional cost at the rate one hour of an instructor's time to ten hours of trainee time. Industries assisted by Special Schools may be requested to provide training equipment unique to specific operations. Special schools for industry programs have been conducted in plants, in the vestibules of plants, in area vo-tech school facilities, or facilities leased or provided for a specific purpose.

From January 1, 1968, through June 30, 1982, the Special School Division, whose name was changed to Training for Industry Programs (TIP) on August 1, 1982, 447 specific training projects were conducted with 44,323 enrolled and 32,646 completing training at a total cost of $4,625,629.54. The average cost to the state of Oklahoma was $141.70 per completer.

During this period of time no firm requirement existed for industry to provide any part of the cost of the training either by cash funding or payment in kind. A statement of understanding was signed for each training project conducted. This statement specified the responsibilities of such participants as the State Department of Vo-Tech, the industry for which training is conducted, and the area vocational-technical school district in which the industry is located.

TIP: EXAMPLE #1 HUFFY

In a training project conducted for the Huffy Corporation, a bicycle manufacturing company at Ponca City, Huffy referred prospective hourly wage employees to vo-tech for training, provided bicycle well building equipment, flux pots and fixtures for brazing, dies for the press, other bending dies, bicycle and bicycle sub assemblies, tubing for brazing training, instructors for the training program (instructors were paid by the State Department of Vo-Tech), consultant services and developmental services for the development of audio visuals, other training aids, and curriculum manuals.

The State Department of Vo-Tech's Special Schools Division provided rented facilities in which to conduct bicycle assembly training (including utilities), custodial and security services for the leased facility, oxygen-acetylene equipment, slat line for assembly line training, tools for workers on the assembly line, air compressors and pneumatic peripheral equipment, an OBI press, paint over-spray and paint touch-up equipment, a fork lift, bus bar for electrical distribution within the training facility, oxygen, acetylene rod and flux, paint, training manuals and course outlines, video tape and other training aids, supervisory development training packages, and first aid training. The State Department of Vo-Tech reimbursed the Huffy Corporation for the salary of instructors provided.

Pioneer Area Vocational-Technical School at Ponca City provided classroom space for supervisory development and first aid training, and training for clerical and maintenance crafts with curriculum specific to Huffy's requirements as needed.

In the Huffy memorandum of understanding, the estimated cost to the State Department of Vocational and Technical Education was $217,368 to provide training to fill 850 job slots. There was no requirement for Huffy to estimate the value of its in-kind contribution to the project, but it was obviously sizeable. Pioneer Area Vo-Tech School was not required to report in-kind or cash contributions to the training program, although it would have been possible to develop an estimate of the total cost.

TIP: EXAMPLE #2 FRANKLIN

A training project was conducted for Franklin Electric Company at Wilburton during 1981. Franklin manufactures electric motors and had projected a need for a start-up labor force of 100 which was expected to grow to 750 hourly wage employees within 5 years. The initial 100 start-up employees were projected to be trained in the skill areas of motor winding, assembly testing and packaging of 6" single and three-phase submersible electric motors.

The project responsibilities were divided between Franklin, Vo-Tech, The Trainees, and Oklahoma Employment Security Commission. Franklin had the major responsibility for trainee recruitment and selection with aid from the Oklahoma Employment Service.

Franklin provided in-plant facilities for pre-employment orientation; qualified employees to do the instructing; recruited trainees; provided technical assistance to help in developing training manuals; paid supervisors while they were undergoing training; required supervisors to maintain weekly objectives, check lists and a schedule of activities while in training; keep required records; and make scheduled reports to Vo-Tech.

State Vo-Tech provided pay for instructors during pre-employment training (in such areas as orientation, safety, quality assurance, employee information), up to $10/trainee in expendable supplies, 150 copies of an employee handbook and a technical procedures manual, necessary video tapes and slides to support the instruction, and tuition for Franklin supervisors provided training in the Siloam Springs, Arkansas, plant.

Trainees were required to attend all pre-employment orientation sessions on their own time without pay.

Cost to the State of Oklahoma, State Department of Vocational and Technical Education was projected to be $272.95/trainee or a total of $27,295.00

OTHER TIP EXAMPLES

It has been stated earlier in this report that 447 training projects had been conducted through TIP for Oklahoma's new and expanding industries by June 30, 1982. The two reported on here, Huffy and Franklin, were not the largest or the smallest but typified the span of projects over the years. Without question the largest project ever conducted was the pre-employment training for General Motors prior to its opening of the Oklahoma City Plant. It began in 1978 and was completed in 1980. 10,393 enrolled for the GM project, with 6,838 completing. Cost to Oklahoma Vo-Tech was $361,927.00 or $52.92/completer or $34.83/enrollee

Another example was the program conducted for Goodyear in Lawton. 825 individuals were enrolled in the program with 741 completing training. Training costs were $389/enrollee or $433/completer at a total cost of $321,149. This program was conducted over a two year period at Great Plains Area Vo-Tech

School and in the plant. One interesting facet of the Goodyear project was that training for maintenance workers began on a Sunday night at midnight with three shifts and continued over approximately one year. Trainees were paid by Goodyear during all facets of the program.

PRODUCTIVITY

On July 1, 1981, the State Department of Vocational and Technical Education established a new division in order to help meet the state's obligation to improve production within the business, industry and government communities. With the knowledge of falling productivity in America and the intimidation and threats arising from the challenge of increased productivity in Japan and Western Europe, Vo-Tech searched for a way to make a unique contribution in this area. The answer seemed to be to work with the first line supervisors and others at the production level. Plant managers and other higher level administrators were being assisted through higher education, but little or no help was being provided at the lower level.

In a cooperative effort with the Governor, the Oklahoma Department of Economic Development, and the Oklahoma State Chamber of Commerce, an Oklahoma Productivity Consortium was formed to develop a program to deal directly with Oklahoma business, industry, and government. The Productivity Consortium will emphasize such areas as: Productivity Awareness, Productivity Measurement, Organizational Management Audit, Interaction Management, Resource Management, Performance Management and Appraisal, Quality Circles, and Process Management.

REPORT ON OPERATIONS OF THE PRODUCTIVITY DIVISION

July 1, 1981 - June 30, 1982

Resources Management Program

Company Name	People Trained
Weyerhaeuser Company, Wright City	77
Weyerhaeuser Company, Craig	15
Kellwood Corporation, Idabel	14
First National Bank of Cushing, Cushing	18
Crowder Tank, Drumright	15
Tulsa County Fair Trust Authority, Tulsa	17
TOTAL	156

The total estimated annual savings resulting from Resource Management training programs conducted during the period of July 1, 1981, through June 30, 1982 was $1,400.847.00. This resulted in an annualized saving per trained employee of $8,979.00.

ORGANIZATIONAL MANAGEMENT AUDIT (OMA)

Four companies utilized program--146 employees surveyed

Company Name

First National Bank of Cushing

Tulsa County Fair Trust Authority

Helicomb International

American State Bank

REPORT ON THE OPERATIONS OF THE PRODUCTIVITY DIVISION

July 1, 1982 - December 31, 1982

Weyerhaeuser Company, Wright City, Oklahoma (Mfg.)

Weyerhaeuser Company, Craig, Oklahoma (Mfg.)

Tulsa County Fair Trust Authority (Govt.)

American State Bank (Financial)

Arkansas Valley Bank (Financial)

Helicomb International (Mfg.)

Interstate Supply Company (Sales & Mkt.)

Allied Materials Inc. (Mfg.)

Business Benefits Agency (Insurance)

Ripley Public Schools (Govt.)

South Oklahoma City Jr. College (Govt.)

Egan Manufacturing (Mfg.)

Weyerhaeuser Corporation reported a total projected annual savings of $1,624,765, as a result of the Resource Management Program to improve productivity presented to supervisory personnel at the Kiamichi Area Vo-Tech School, Idabel Campus. Other corporations have reported increased productivity and more effective operations although to a somewhat less dramatic extent.

A twenty member Governor's Advisory Board on Productivity guides the operation of the Productivity Consortium. Instructors for productivity training are members of the staff of the State Department of Vo-Tech. All productivity manuals and other instructional materials are paid for by the businesses, industries, or governmental agencies for which productivity training is provided.

BITS
(Business/Industrial Training Services)

Although BITS is a multi-faceted division of Vo-Tech, only the Existing Industry Program and the aspects of its operation that relates to industry specific training, are discussed in this report.

The Existing Industry program is designed for industries (firms already located in Oklahoma) who are introducing new technologies, processes, and "new thrusts" to increase or maintain their current level of productivity. "New thrusts" may include a new line, diversifying products, new manufacturing processes, new equipment, or similar innovations. If the technology or new thrusts result in a training need, then Existing Industry is the Vo-Tech program designed to meet the industry's requirement.

Programs are conducted by the area vo-tech school district in which the industry is located. The area school develops a training agreement with the industry and requests resources needed from the State Department of Vo-Tech. (If the area school can meet the industry's need without assistance from the state, the school conducts the program as a regular short-term program.)

All training approved as "Existing Industry Training" must be industry-specific. This requires that it be customized for a specific industry need. All industries are considered equally without regard to whether they are service, manufacturing, health care, assembly, or other type of operation.

Existing Industry Training is somewhat similar to the type of training that has been delivered by the State Department of Vo-Tech to new and expanding industries for several years. The State Department of Vo-Tech allocates funds to area schools for customized training to:

a. provide additional resources to schools who have the expertise to do the training but do not have the resources.

b. provide more resources for industries which need the training through involving more trainers. (Training equipment and related aids and materials are being provided to schools that need assistance.)

c. encourage industries to work more closely with the local vo-tech schools and allow the State Department of Vo-Tech to function as a service, support agency.

d. increase the number and types of industries or businesses being served (training for new and expanding industries has been concentrated in manufacturing and assembly operations).

Each vo-tech school applying for funds to the State Department justifies need, verifies resources available at the local level, and requests other resources when needed.

When projects are approved, local project directors at the school are assigned the responsibility for the training and are required to monitor and assist. Other support is provided by the Business/Industrial Training Services Division (BITS) and the Training for Industry Programs Division (TIP).

Two examples of Existing Industry Training Programs are: Bartlett Collins at Central Oklahoma Area Vo-Tech, Drumright, and Brown and Root (Weyerhaeuser) at Kiamichi Area Vo-Tech, Idabel.

Bartlett Collins

Bartlett Collins is a table glassware manufacturing company located in the Central OK Area Vo-Tech School District at Sapulpa. The manufacturing process has been streamlined by the addition of two new machines at a cost of 2.6 million dollars, requiring the entire maintenance crew to be trained in electronics. This company had 300 employees on a stable basis for six months and no layoffs are forecast.

The Bartlett Collins training will be for a period of 300 clock hours at a total cost of $13,765 of which $10,640 will come from State Department of Vo-Tech funds.

Brown and Root (Weyerhaeuser)

Brown and Root, Inc. which serves as a contract equipment operator for Weyerhaeuser at Valliant requires upgrading for 200 employees due to new and expanded equipment installed by Weyerhaeuser in its paper plant. While Kiamichi Area Vo-Tech School's programs in Welding and Industrial Maintenance had some equipment, instructors and technical assistance available, they could not conduct the proposed project without assistance from the State Department of Vo-Tech. The total cost of the program is estimated to be $631,651 with $198,920 coming from the Kiamichi Area Vo-Tech School, $196,400 from the industry, and the balance from the State Department of Vo-Tech. Training competency desired in the program will be developed by the industry and Kiamichi Area Vo-Tech School.

Existing Industry Training at the time of the development of this report has been in operation less than a year, but it is attempting to provide for existing industry, the backbone of Oklahoma's economy, a service equal to that provided since 1968 for new and expanding industries. All existing industry programs are monitored by the BITS staff and other employees of the State Department of Vo-Tech.

Industry Support to Vo-Tech Education

All industries assisted by the TIP, BITS, or Productivity Divisions of Vo-Tech, be they manufacturing, service or governmental, participated to some extent in the cost of the training that was provided. The State Department of Vo-Tech Education grants that much of industry's participation was on the order of equipment, technical assistance, or other in-kind contribution and that the industries assisted were not required to keep specific records of their contributions.

A very supportive relationship has developed between Oklahoma industries and vo-tech at the state and local levels. Industry representatives serve on advisory committees and curriculum committees.

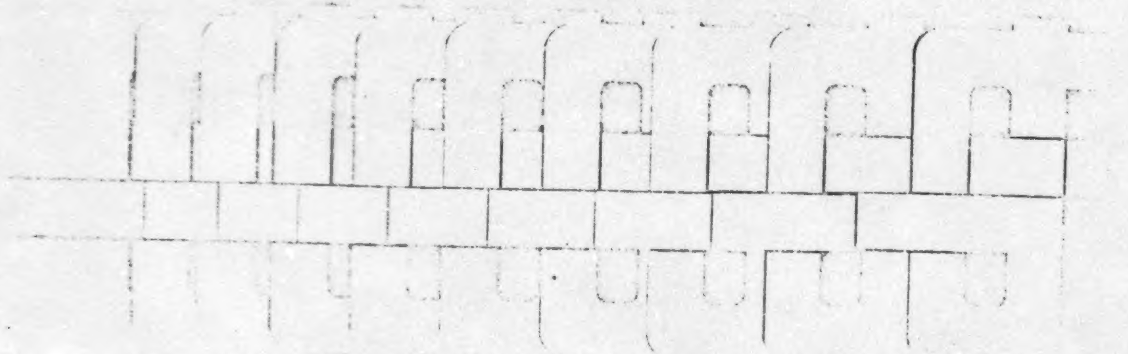
An often overlooked contribution of industry to vo-tech is the equipment provided to other training programs, not necessarily industry specific. No reports are required of area vo-tech schools regarding equipment that has been donated to them. In a recent survey, Canadian Valley Area Vo-Tech School, El Reno, reported $195,000 in equipment and materials donated; Central OK Area Vo-Tech School, Drumright, reported $323,000 in donated equipment; Kiamichi Area Vo-Tech School $12,800; Moore-Norman Area Vo-Tech School $104,000; and Red River Area Vo-Tech School, Duncan, $15,000. Many other schools reported the donation of equipment without relating a value. For instance, Mid-America Vo-Tech reported among the donations they have received were three stallions, seven mares and three geldings for their equine program.

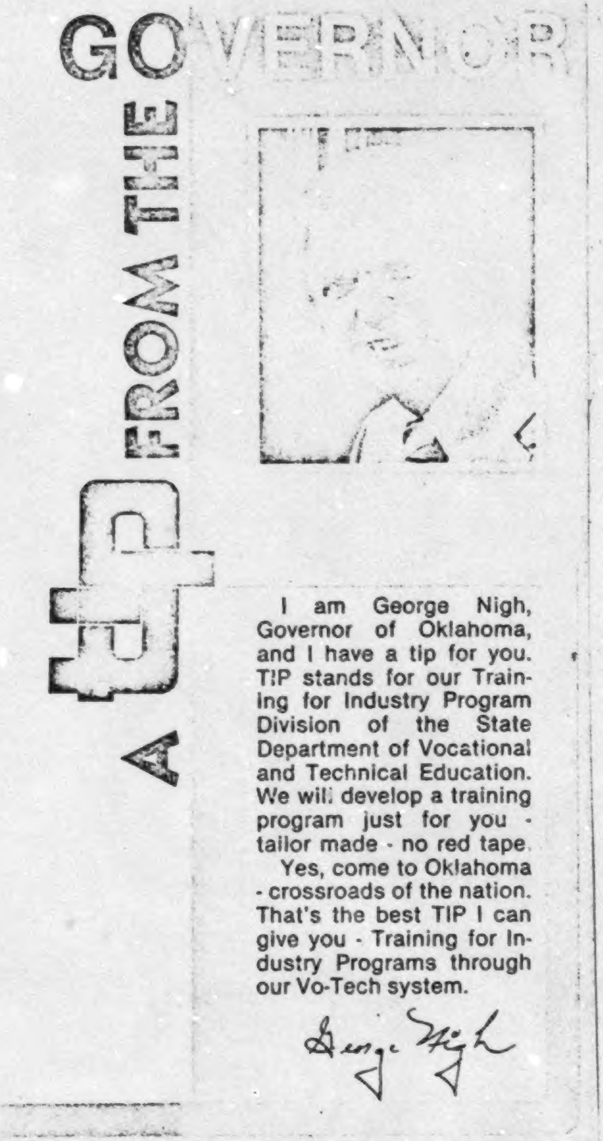
Industry and education are mutually supportive. Skill training delivered to industry by Vo-Tech through an efficient and productive work force welds a relationship between the two that would otherwise be impossible. As Vo-Tech provides better service to Oklahoma industry, business, and government, contributions in cash and in-kind are expected to grow. As an example of this growing relationship, Fort Howard Paper Company of Muskogee donated $15,000 to buy equipment for the Indian Capital Area Vo-Tech School.

While industry specific training was begun as a tool to be used to assist in the industrial and economic development of Oklahoma, it has become much more. Industry specific training assists Oklahoma workers to further develop existing skills, learn new skills, improve their productivity, thus resulting in continued employment, promotion, and higher pay. It is not a one-sided operation that benefits only "Big Industry." It helps all Oklahomans.

OKLAHOMA

Training for Industry Programs





A TIP FROM THE GOVERNOR

I am George Nigh, Governor of Oklahoma, and I have a tip for you. TIP stands for our Training for Industry Program Division of the State Department of Vocational and Technical Education. We will develop a training program just for you - tailor made - no red tape.

Yes, come to Oklahoma - crossroads of the nation. That's the best TIP I can give you - Training for Industry Programs through our Vo-Tech system.

George Nigh

vo-tech Training For Industry

The Industrial Technical Services Division of the STATE DEPARTMENT OF VOCATIONAL AND TECHNICAL EDUCATION has been established to assist NEW AND EXPANDING OKLAHOMA INDUSTRIES. This division has Business and Industrial Training Coordinators responsible for communicating present and future manpower needs of new and/or expanding industries by visiting industry on a planned basis. Coordinators serve as advisors and consultants on all training programs and develop a training package that will best meet the needs of business and industry. Coordinators also inform industries of the Vocational and Technical programs and all other manpower programs that could be of assistance to the company and its personnel. The programs would include, but not be limited to, the TRAINING FOR INDUSTRY PROGRAMS, the Vo-Tech training programs at Area Vocational Technical Schools, Skills Centers and Technical Institutes.

OKLAHOMA STATE DEPARTMENT OF VOCATIONAL
AND TECHNICAL EDUCATION
INDUSTRIAL AND TECHNICAL SERVICES DIVISION
4024 Lincoln Blvd.
Oklahoma City, Oklahoma 73105
Phone: (405) 521-2195

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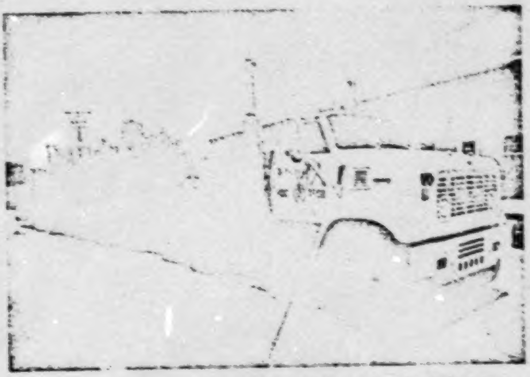
Vo-Tech will develop training manuals.



Vo-Tech has the capabilities to transport training materials to the training site.

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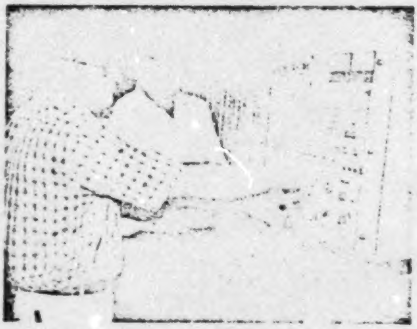


Training for Industry Programs...

The Training for Industry Programs Division of the State Department of Vocational and Technical Education works with companies to provide an initial work force for the new plant. Each new company has its own peculiar plant-start problems, and training programs are designed to alleviate these problems.

BEST COPY AVAILABLE

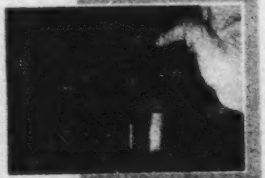
OKLAHOMA vo-tech

welcomes YOU!

OKLAHOMA

Training for Industry Programs

Vo-Tech has the capabilities to support training [illegible] needs in any training site.



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The Training for Industry Programs Division of the State Department of Vocational and Technical Education works with companies to provide an initial work force for the new plant. Each new company has its own peculiar plant, plant problems, and training programs are designed to meet these problems.

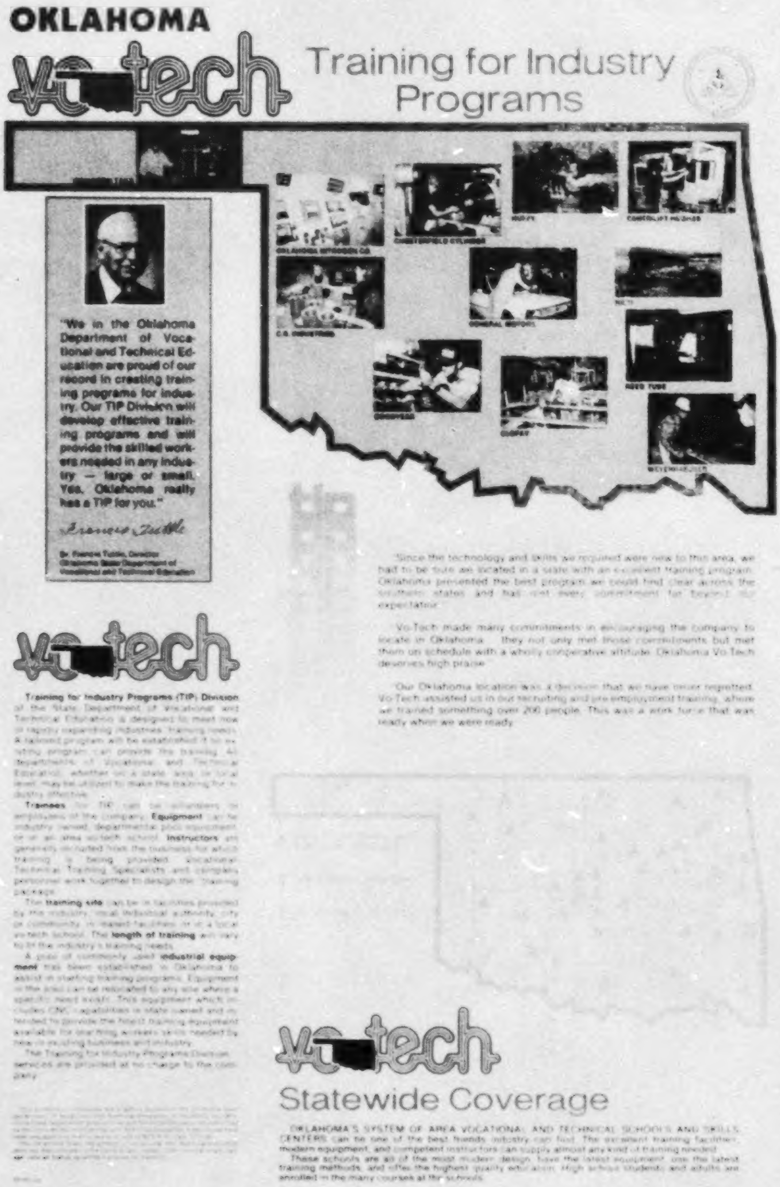
vo-tech Training For Industry

The Industrial Technical Services Division of the STATE DEPARTMENT OF VOCATIONAL AND TECHNICAL EDUCATION has been established to assist NEW AND EXPANDING OKLAHOMA INDUSTRIES. This division has Business and Industrial Training Coordinators responsible for communicating present and future manpower needs of new and/or expanding industries by visiting industry on a planned basis. Coordinators serve as advisors and consultants on all training programs and develop a training package that will best meet the needs of business and industry. Coordinators also inform industries of the Vocational and Technical programs and all other manpower programs that could be of assistance to the company and its personnel. The programs would include, but not be limited to, the TRAINING FOR INDUSTRY PROGRAMS, the Vo-Tech training programs at Area Vocational Technical Schools, Skills Centers and Technical Institutes.

OKLAHOMA STATE DEPARTMENT OF VOCATIONAL
AND TECHNICAL EDUCATION
INDUSTRIAL AND TECHNICAL SERVICES DIVISION
4024 Lincoln Blvd.
Oklahoma City, Oklahoma 73105
Phone (405) 521-2195

A TIP FROM THE GOVERNOR

[illegible] Department of Vocational and Technical Education [illegible] will develop a training program just for you [illegible] other needs [illegible]. You, come to Oklahoma - crossroads of the nation. That's the best TIP I can give you - Training for Industry Programs through our Vo-Tech system.



OKLAHOMA NITROGEN CO.
CHESTERFIELD CYLINDER
C.E. INDUSTRIES
GENERAL MOTORS
GOODYEAR
WEYERHAEUSER

OKLAHOMA vo-tech Training for Industry Programs

"We in the Oklahoma Department of Vocational and Technical Education are proud of our record in creating training programs for industry. Our TIP Division will develop effective training programs and will provide the skilled workers needed in any industry — large or small. Yes, Oklahoma really has a TIP for you."

Francis Tuttle

Dr. Francis Tuttle, Director
Oklahoma State Department of
Vocational and Technical Education

vo-tech

Training for Industry Programs (TIP) Division of the State Department of Vocational and Technical Education is designed to meet new or rapidly expanding industries' training needs. A tailored program will be established if no existing program can provide the training. All departments of Vocational and Technical Education, whether on a state, area, or local level, may be utilized to make the training for industry effective.

Trainees for TIP can be volunteers or employees of the company. **Equipment** can be industry owned, departmental pool equipment, or of an area vo-tech school. **Instructors** are generally recruited from the business for which training is being provided. Vocational-Technical Training Specialists and company personnel work together to design the training package.

The **training site** can be in facilities provided by the industry, local industrial authority, city or community, in leased facilities or in a local vo-tech school. The **length of training** will vary to fit the industry's training needs.

A pool of commonly used **industrial equipment** has been established in Oklahoma to assist in starting training programs. Equipment in the pool can be relocated to any site where a specific need exists. This equipment which includes CNC capabilities is state owned and intended to provide the finest training equipment available for teaching workers skills needed by new or existing business and industry.

The Training for Industry Programs Division services are provided at no charge to the company.

"Since the technology and skills we required were new to this area, we had to be sure we located in a state with an excellent training program. Oklahoma presented the best program we could find clear across the southern states and has met every commitment far beyond our expectations."

"Vo-Tech made many commitments in encouraging the company to locate in Oklahoma ... they not only met those commitments but met them on schedule with a wholly cooperative attitude. Oklahoma Vo-Tech deserves high praise."

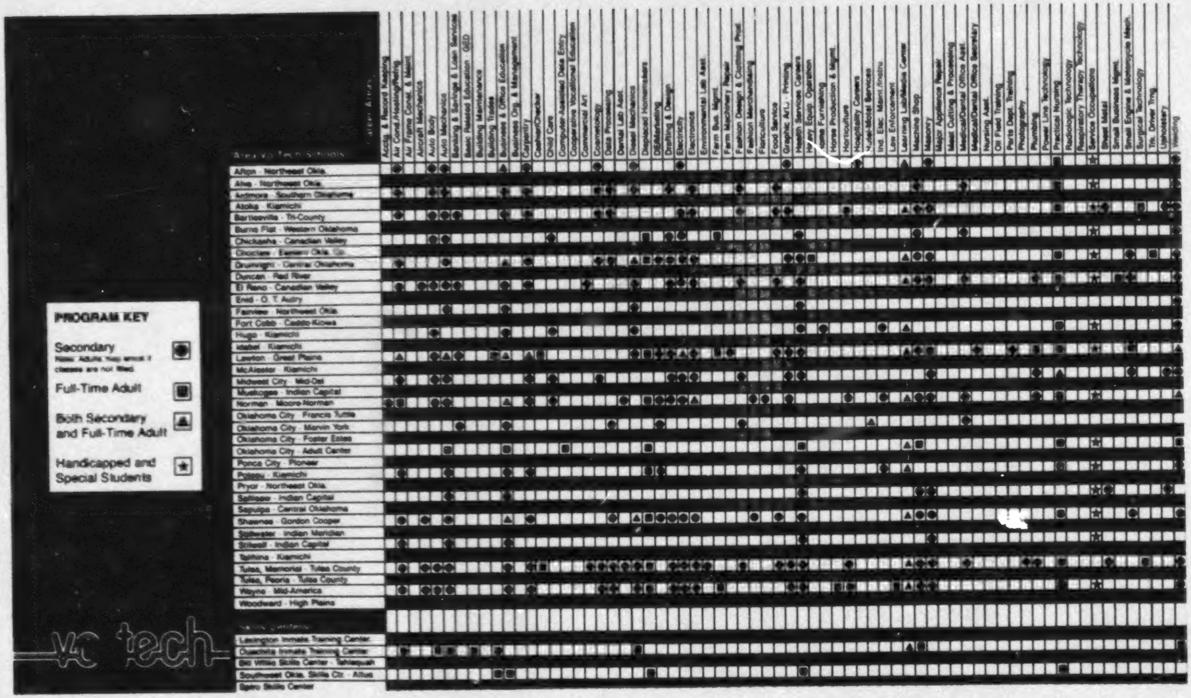
"Our Oklahoma location was a decision that we have never regretted. Vo-Tech assisted us in our recruiting and pre-employment training, where we trained something over 200 people. This was a work force that was ready when we were ready."

vo-tech Statewide Coverage

OKLAHOMA'S SYSTEM OF AREA VOCATIONAL AND TECHNICAL SCHOOLS AND SKILLS CENTERS can be one of the best friends industry can find. The excellent training facilities, modern equipment, and competent instructors can supply almost any kind of training needed.

These schools are all of the most modern design, have the latest equipment, use the latest training methods, and offer the highest quality education. High school students and adults are enrolled in the many courses at the schools.

BEST COPY AVAILABLE



Career Areas

Acctg. & Record Keeping
Air Cond./Heating/Refrig.
Air Frame Const. & Maint.
Aircraft Mechanics
Auto Body
Auto Mechanics
Banking & Savings & Loan Services
Basic Related Education · GED
Building Maintenance
Building Trades
Business & Office Education
Business Org. & Management
Carpentry
Cashier/Checker
Child Care
Computer Assisted Data Entry
Cooperative Vocational Education
Commercial Art
Cosmetology
Data Processing
Dental Lab Asst.
Diesel Mechanics
Displaced Homemakers
DE/Marketing
Drafting & Design
Electricity
Electronics
Environmental Lab Asst.
Farm Bus. Mgmt.
Farm Machinery Repair
Fashion Design & Clothing Prod.
Fashion Merchandising
Floriculture
Food Service
Graphic Art. - Printing
Health Services Careers
Heavy Equip. Operation
Home Furnishing
Horse Production & Mgmt.
Horticulture
Hospitality Careers
Hotel-Motel Services
Ind. Elec. Maint./Instru.
Law Enforcement
Learning Lab/Media Center
Machine Shop
Masonry
Major Appliance Repair
Meat Cutting & Processing
Medical/Dental Office Asst.
Medical/Dental Office Secretary
Nursing Asst.
Oil Field Training
Parts Dept. Training
Photography
Plumbing
Power Line Technology
Practical Nursing
Radiologic Technology
Respiratory Therapy Technology
Service Occupations
Sheet Metal
Small Business Mgmt.
Small Engine & Motorcycle Mech.
Surgical Technology
Tri. Driver Trng.
Upholstery
Welding

Area Vo-Tech Schools

Afton - Northeast Okla.
Alva - Northeast Okla.
Ardmore - Southern Oklahoma
Atoka - Kiamichi
Bartlesville - Tri-County
Burns Flat - Western Oklahoma
Chickasha - Canadian Valley
Choctaw - Eastern Okla. Co.
Drumright - Central Oklahoma
Duncan - Red River
El Reno - Canadian Valley
Enid - O. T. Autry
Fairview - Northwest Okla.
Fort Cobb - Caddo-Kiowa
Hugo - Kiamichi
Idabel - Kiamichi
Lawton - Great Plains
McAlester - Kiamichi
Midwest City - Mid-Del
Muskogee - Indian Capital
Norman - Moore-Norman
Oklahoma City - Francis Tuttle
Oklahoma City - Marvin York
Oklahoma City - Foster Estes
Oklahoma City - Adult Center
Ponca City - Pioneer
Poteau - Kiamichi
Pryor - Northeast Okla.
Sallisaw - Indian Capital
Sapulpa - Central Oklahoma
Shawnee - Gordon Cooper
Stillwater - Indian Meridian
Stilwell - Indian Capital
Talihina - Kiamichi
Tulsa, Memorial - Tulsa County
Tulsa, Peoria - Tulsa County
Wayne - Mid-America
Woodward - High Plains

Skills Centers

Lexington Inmate Training Center
Ouachita Inmate Training Center
Bill Willis Skills Center - Tahlequah
Southwest Okla. Skills Ctr. - Altus
Spiro Skills Center

PROGRAM KEY

Secondary ●
Note: Adults may enroll if classes are not filled.

Full-Time Adult ■

Both Secondary and Full-Time Adult ▲

Handicapped and Special Students ★

vo tech

High School Students

The purpose of the area vo-tech school is to provide training to those who wish to learn a skill in order to obtain employment upon completion of high school or to help work their way through college.

Students enrolled in an area vo-tech school spend one-half day at the vo-tech school and one-half day at the home high school.

Transportation is provided by the vo-tech school from and back to the home high school.

Student on-the-job-training and placement on a job are provided at the area vo-tech schools.

Most programs are two years in length; however, some programs require only one year of training.

Adult Students

The purposes of the area vo-tech schools are to provide (1) training to those who wish to learn a skill in order to obtain employment and (2) training to those employed to increase their proficiency and upgrade their skills, thereby increasing their earning capabilities.

Adult students may attend one-half day (3 hours) or all day (6 hours). Short-term training is available in the evenings.

FINANCIAL ASSISTANCE

Financial assistance for adult students is available at most area vo-tech schools:

1. Basic Education Opportunity Grant Program (BEOG)
2. Oklahoma Tuition Aid Grant (OTAG)
3. Guaranteed Student Loan
4. Federal G.I. Bill and Oklahoma G.I. Bill (for veterans and children of certain veterans)
5. Comprehensive Employment and Training Act (CETA)
6. Indian Tribes and Bureau of Indian Affairs
7. Vocational Rehabilitative Services
8. Foundation Scholarships and Grants
9. Work Study Program

Contact your nearest area vo-tech school. Ask for an appointment with a counselor or the teacher of the skill area in which you are interested. They will be glad to talk with you.

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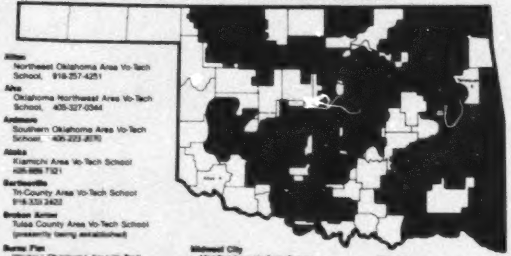
OKLAHOMA AREA VOCATIONAL-TECHNICAL SCHOOLS AND SKILLS CENTERS



Afton
Northeast Oklahoma Area Vo-Tech School, 918-257-4251

Alva
Oklahoma Northwest Area Vo-Tech School, 405-327-0344

Ardmore
Southern Oklahoma Area Vo-Tech School, 405-223-2070

Atoka
Kiamichi Area Vo-Tech School
405-889-7321

Bartlesville
Tri-County Area Vo-Tech School
918-333-2422

Broken Arrow
Tulsa County Area Vo-Tech School
(presently being established)

Burns Flat
Western Oklahoma Area Vo-Tech School, 405-562-4812

Chickasha
Canadian Valley Area Vo-Tech School
405-224-7220

Choctaw
Eastern Oklahoma County Area Vo-Tech School, 405-390-9591

Drumright
Central Oklahoma Area Vo-Tech School, 918-352-2551

Duncan
Red River Area Vo-Tech School
405-255-2903

El Reno
Canadian Valley Area Vo-Tech School
405-262-2629

Enid
O. T. Autry Area Vo-Tech School
405-242-2750 or 405-234-0183

Fairview
Oklahoma Northwest Area Vo-Tech School, 405-227-3708

Fort Cobb
Caddo-Kiowa Area Vo-Tech School
405-643-2387

Hugo
Kiamichi Area Vo-Tech School
405-326-6491

Idabel
Kiamichi Area Vo-Tech School
405-286-7555

Lawton
Great Plains Area Vo-Tech School
405-355-6371

McAlester
Kiamichi Area Vo-Tech School
918-426-0940

Midwest City
Mid-Del Area Vo-Tech Center
405-737-6604

Muskogee
Indian Capital Area Vo-Tech School
918-687-6383

Norman
Moore-Norman Area Vo-Tech School
405-364-5763

Oklahoma City
Oklahoma City Area Vo-Tech School
Administrative Offices
405-840-0141
Marvin York Site, 405-848-7747
Foster Estes Site, 405-672-3371
Adult Center, 405-524-2319

Oklahoma City
Francis Tuttle Area Vo-Tech Center
405-722-7799

Ponca City
Pioneer Area Vo-Tech School
405-762-8336 or 405-762-8337

Poteau
Kiamichi Area Vo-Tech School
918-647-4525

Pryor
Northeast Oklahoma Area Vo-Tech School, 918-825-5555

Sallisaw
Indian Capital Area Vo-Tech School
918-775-9119

Sapulpa
Central Oklahoma Area Vo-Tech School, 918-224-9300

Shawnee
Gordon Cooper Area Vo-Tech School
405-273-7493

Stillwater
Indian Meridian Area Vo-Tech School
405-377-3333

Stilwell
Indian Capital Area Vo-Tech School
918-696-3111

Talihina
Kiamichi Area Vo-Tech School
918-567-2264

Tulsa
Tulsa County Area Vo-Tech School
Memorial Ave. Campus
918-627-7200
Peoria Ave. Campus, 918-428-2261

Wayne
Mid-America Area Vo-Tech School
405-449-3391

Wilburton
Kiamichi Area Vo-Tech School
Administrative Offices, 918-465-2323

Woodward
High Plains Area Vo-Tech School
405-256-6618
(Presently being established)

A. **Altus**
Southwest Oklahoma Skills Center
405-477-2250

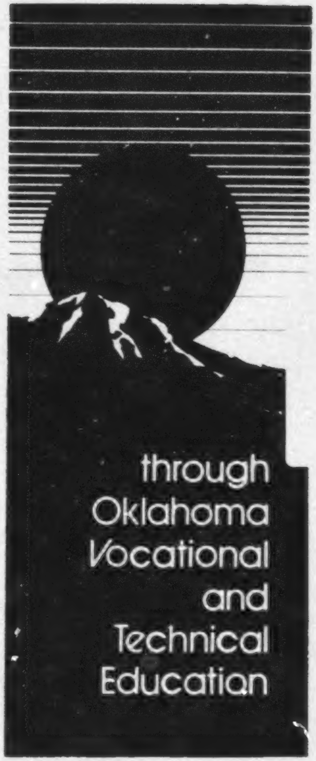
B. **Hodgens**
Ouachita Inmate Training Center
918-653-4826

C. **Lexington**
Lexington Inmate Training Center
405-527-2191

D. **Spiro**
Spiro Skills Center
918-962-3722

E. **Tahlequah**
W. P. "Bill" Willis Skills Center
918-456-2594

82-00147



through
Oklahoma
Vocational
and
Technical
Education

Mr. GORE. Thank you, Mr. Tuttle.

Our final witness this morning is Michael Odom, with the Digital Equipment Corp., and currently an executive on leave with the Hubert Humphrey Occupational Resources Center in Roxbury, Mass.

Mr. Odom, we are delighted to have you and your prepared remarks will be put into the record. If you care to summarize any portion of your oral comments, please feel free to do so.

Mr. ODOM. Thank you, Mr. Chairman, and committee members. I am really very pleased to be here because I have been working in the area of trying to link high technology with schools since 1976.

When we started with the State college system, we were fairly lonely feeling about the need for it. We knew there was a need, but not many people in the community knew that. Now, as I listen to testimony and read the newspaper—in fact, this morning, there was a piece about artificial intelligence in Japan and competition. I think it has become quite a trendy topic.

This time around, though, the trend is going to be with us, at least until the beginning of the next century, and perhaps longer. My work has been with the public schools lately, the last 3 years.

We have a factory in Roxbury and it happened to have opened the same year that the Roxbury Center where I am assigned opened. We have a great deal of concern about innercity residents and what is going to happen to them, and women, what is going to happen to them around the issues of technology, if industry and education and government do not join together to reach out.

In fact, we see this evolving as an equity issue in the rest of this century. If people cannot understand what the technology is all about, if they do not have knowledge, they cannot be knowledged workers, it is fairly apparent, if most of the jobs are going over to the service sector or the knowledge sector, or both.

One of the interesting things for me as a visitor inside the school is to see how really very fine the school people were. There is, I think, a lot of distrust on the part of business people about schools. When you work inside, you find that they are at least the equal of the people you work with when you are back in your home office.

They care very much about the children, they are perplexed by societal changes and as intelligent as you are about what may be happening and puzzled by it.

That is why I would like to recommend partnerships as one small piece to this puzzle that we are talking about today, but there certainly is no total answer to it, and I do not pretend to know what the total answer to it is.

In terms of the public schools, I think we are asking them to sort of go into a world series and we are not giving them any support to speak of. We are criticizing them a lot. We are saying, hey, go get them, and then we walk away. I think there is a danger that if we do that, we are going to have another opportunity to criticize.

For example, throwing money at them in terms of new programs around math and science and not giving them help about the career piece and why math and science is relevant to the kids is probably not a very good idea.

I have gotten to know some guidance people and I think if I were to prioritize the people who need help in school, math and science would be up top because of the importance of the piece, but the guidance people need help in terms of linkages to what is going on out in the real world.

We have thrust drug rehabilitation, and in the cities, unmarried mother problems, and all kinds of social problems on the guidance counseler and then said, oh, by the way, also tell the kids where the jobs are going to be. But we have not given them any help. That is very tragic.

I have had two partnering relationships in the last year, one with the Boston schools and one with the Oxford, Mass., system, which is a rural, blue-collar town about 50 miles west of Boston.

The difference between working with a large school and a small one is instructive because in the large school, you are dealing with an infrastructure and a set of decisionmakers which make a very complex set of steps before a change can be implemented. Working with Oxford, we were able to make quicker changes for fewer numbers of people.

I think the lesson for us is that even though we are not going to be able to hire anybody from Oxford probably, because they are a long way from our facilities, working with them has been worthwhile because we have learned a lot about the smaller school system and the kinds of help they need, and we have learned that the equipment that we give the smaller system may be much smaller in scope than the big system, but its impact can be even greater over a smaller number of people.

Coupled with one of the Federal initiatives, the Teacher Center, French River Teacher Center in Oxford, that help in Oxford has been like yeast; they've taken the help that we have given them and trained other teachers and set up a program where we will provide 5 microcomputers for each of 25 schools. We will not have to train the teachers; the Oxford School people will.

They are doing things that we could do, but would prefer not to. They are doing appropriate things in terms of being teachers and culture bearers to their constituent teachers in the 25 towns, and we are being good neighbors. I think that is an interesting model.

Because of Oxford's work, the National Diffusion Network here in Washington gave them a Lighthouse award—they are 1 of 5 in the country. We received a Presidential citation along with the Oxford School System for partnering.

I think if you had to sum up the lessons we learned about partnering, it is probably just simply being open to negotiation. It is very much like a courtship and a marriage, as compared to some other kind of human relationships which are not as friendly as that.

Trust and openness on both sides allow you to build a needs analysis which makes sense. What do we bring as a company with technical information, with software, with hardware, knowledge of the job market? What do they bring in terms of knowledge of young people? When you put those two pieces together with some trust, I think good things can happen.

It can be very painful when it does not happen well and when they are bad motives, but in both of those cases, by and large, we have had good results.

I think I am especially proud about Boston because we have acted as a catalyst and then the school people in Boston have taken over and gone after a very exciting program whereby 15 terminals will be in every school by 1987, which would be very unusual because Boston, if you recall, has been in a crisis for 10 years around desegregation, economic crisis; they have had several superintendents. We have an administration in the city and a superintendent in a school committee now that is really working around a thing called a Compact.

The reason I mention the computer piece of it is that that is my piece, but the compact as a notion is an exciting one for the city.

It is a contract, if you will, between business people and the schools that they will cooperate along the lines that I described Digital in Oxford and Digital of Boston have been doing.

The companies are putting up jobs and the schools are putting up the promise that our kids can read and write by 1986. As Bud Spillane, our superintendent, said, "We are only doing what we should be doing, but for the first time, we are being positive and making it grow and now it is going to work and the kids are going to have jobs."

They will not all be entry-level, trivial jobs because of places like the Humphrey Center and Boston Tech in industry involvement. We are going to be sure that the curriculum is getting the youngsters ready for internships and part-time jobs while they go to college or community college. So I think it is a very positive development for large cities.

It would not surprise you if I told you that there are some problems around industry/education partnering. One of the problems is lack of definition about what we should do and what they should do. That is why one of the innovations that I think was important was a thing called key results planning, which invites the school people and the business people to get together and do some joint planning so that they come up with a blueprint for the next year and for the next 5 years.

Indeed, we did not have a mission statement when I got to the school, and we worked out a mission statement in a retreat out in Wellesley. We took everyone away. First time all the people who were getting ready to open the school had been together in one room at one time. And as busy as everyone is this room is, I guess you can understand that.

But it was surprising when you think that they had the school planned; it was $40 million planning and another $20 million or so of facilities and equipment, but they had never said, what business are we in? What are the kids going to be able to do when they get out?

So we forged a plan that was very simple. It said that by the end of the time that the youngsters are in school, they will either be able to get a job or go on to further education.

Well, that sounds trivial, but it starts operationally defining every step that comes after that. The Key Result Plan came out of the University of New Hampshire in Dover, the center called Center for Constructive Change, and that model is now the planning and reporting model for the Humphrey Center and for the compact and for the tri-lateral.

Now, in terms of cost to the company, it was a consultant for a few days, which was trivial, they hired him, by the way, and he is in the school system. But that was in an intervention which we did not foresee; it was not really a Digital intervention as such. It was sort of a tangential or a sideways intervention. It made a great deal of difference.

Now we can reality-test notions about new curriculum models, or additions of techniques, our staff, against a charter, mission statement, and key results.

Another thing I would like to tell you about is that, because I happen to work for a computer company, we are using the computer in several ways, which I think may have relevance. One is in basic skills remediation around a software package called Dolphin. It remediates grade 3 through 8 reading math and problem solving, and we are finding youngsters who normally would not go near workbooks are staying on the terminals.

By the way, the terminals consist of 40 digital terminals off an 1170 system that we provided, and it was a coincidence, and a very happy one, that that software ran on that. We also have 40—I am sorry, 20 other microcomputers for initial training in the lab. The reason I mention that is that there are really two basic ways computers are useful in our setting: One is awareness of what is happening in computer-based jobs and high technology and robotics, and you can have curriculum built around micros which can be very effective.

The next level would be the computer used either to train the kids in content areas or to give them data-processing skills. Those are the two ways in which we use the equipment.

I hear a lot of folks in schools and workshops I visited around the Commonwealth talking about cost of equipment. I no longer think cost is really the element anymore, because if you look in the newspaper today in Washington, I am sure discount toy stores are selling little microcomputers for $49, which can train children in the basics.

If you have a TV set, you then have a small computer in the basics of programing. So it is not necessarily the hardware piece that is the acquisition cost, but it is the intellectual piece of getting teachers ready to understand what the technology is about, where jobs may be, and where it is all headed.

It is the kind of basic computer literacy that youngsters get in the first, second, or third grade when they learn to read and write. It is sort of a primer of computer literacy.

There is no curriculum around it yet, but I think we will probably see one.

The other point I would like to make is that Digital has the same problem that you are exploring here, that is, the problem of retraining and lifelong learning.

We have one strategy internally that we are experimenting with built around a microcomputer and a video disk that allows the student, at his or her own pace, to sit before a color television-like device with a picture that is about four times clearer than a color television set and interact with that set of 54,000 still images or 1 hour of recorded television material and have overlaid over it, in very, very crisp graphics, things like a diagram of a machine.

By putting most of the instruction on a floppy disk, the high cost of the video disk can be extended to 6 to 7 hours of instruction.

We are very excited because we have to decentralize our training more and more because our machinery that we sell is getting less expensive, and it is inappropriate and too expensive to bring people to Boston to train them.

So we decentralize and that new device is promising. I mention it because it is the kind of device that I think the committee will be seeing over the next 5 years in the first industrial training and military training markets and then in the school market. It is too expensive for schools now, but I think it is worthwhile looking at that technology as I am sure you are already looking at it, to see how it might have a high front-end cost, low unit-delivery cost for schools, perhaps around math and science.

That brings me to my second point. We have invited half a dozen teachers from Lexinton-Lynfield into Digital to be in residence with us to learn how to build software for that machine around high school subject and they have begun that process.

We have also invited, through the University of Massachusetts program for retraining—or rather, training teachers for math and science, an experimental plan where 12 recent graduates from the hard sciences in the New England area become candidates for a master's program and they spend a semester at Digital and are paid as if they were Digital employees working in our course development area around areas of computer-based education, quality assurance of educational materials, and that sort of thing.

Then they have committed to go back to the public schools and teach for 3 years. It is a venture through a number of suburban high school superintendents, the University of Massachusetts at Amherst, and Digital, and other high-tech companies.

We also have another program which I think is interesting. The reason that I think it is interesting is that it is the first national program in community college networking that I have heard of. It is called minicomputer technology. It started about 1975. We knew we needed technicians to repair our machines; we knew that the initial training was becoming very expensive, and we wanted to decentralize that to the college.

We offered them relationships where we would discount equipment at 50 percent and provide them with curriculum and instructor training. We now have 25 such colleges like that around the country.

We only sign up colleges who are heavily minority-oriented and we only are interested in hiring a few people from each college each year so those other people are able to go to other companies.

So it is technology sharing at a national level that we have not talked about very much, but it has worked extremely well, we think, for the colleges. We know it has worked extremely well for us.

I guess to sum up, companies like Digital, I think as you start looking around the country you will find, have linkages that are already grassrooted into their communities in a number of ways. Companies like Digital are making change in the workplace and I think we have got a corporate commitment to try to do something about softening the impact of the change through education and linkages.

I just want to offer my help in linking you to anyone in our company in the areas of artificial intelligence or education and training that might be helpful to you in the future.

Thank you.

[The prepared statement of Mr. Odom follows:]

Remarks by:
Michael Odom
7 April 1983

Today, I appear before you as a private citizen. I want to tell your Subcommittee about Boston's exciting computer literacy outreach to all public school students. For three years, I have been Digital's executive-on-loan to the Boston Public Schools. However, my remarks today are entirely my own view and do not necessarily reflect the views of either Digital Equipment Corporation or the Boston Public Schools.

Recently, public-private partnering has become a fashionable topic. Perhaps some experiences from this Boston-Digital partnership will prove useful to other companies and other schools. I am also working linkages with several other schools and community-based organizations in Massachusetts, both urban and suburban, concerning access to computers for women, minorities and disadvantaged youth. The partnering idea, when both sides really cooperate, works in all these settings.

Yesterday, you heard experts testify about the technological revolution in the workplace. Unlike more leisurely social revolutions of the past, this one does not have good party manners. Revolutions always put the heaviest burden on the poor and uneducated. This revolution, because it is built upon knowledge, will by-pass the uneducated. In tomorrow's world of knowledge workers, those without knowledge will *not* be workers.

Americans are discovering that training and education will be core issues for equity from now on. Since our public schools have traditionally prepared our children for work or further education, business and government are taking a critical new look at schools. Such interest is good business; a graying workforce and coming scarcity of entry-level workers makes partnerships a matter of enlightened self-interest.

We Americans have heaped responsibility after responsibility at our schools, but usually not the resources they need. Not surprisingly, many critics now say these same schools are in trouble. As resources shrink and enrollments decline, taxpayers, too, are becoming especially critical. Informed criticism is healthy. But ignorant criticism is frightening because it can create a climate of public distrust.

My partnering experience convinces me that the single most powerful feature of a school-business linkage is simply that both sides get to know each other. Neither side is perfect; schools and businesses both have lots of human failings. But in a healthy partnership, you can deal with facts and issues and first-hand impressions and not just preconceptions. The power of accurate information works as potently in partnerships as it does in the information revolution.

Public schools are one major foundation stone of our human resource system. This new revolution is asking a total response from our schools. Our earlier social revolutions had better manners; they gave Americans ample time to adapt to innovation. Today's revolution has no manners. It's more like a young rookie, friendly enough but skittish and unpredictable. With careful training, he could win the ball game but un-coached, he could wander off to another club or sink down in the minor leagues, while Americans sink down in stagflation.

After years of neglect, American industry is asking our schools to step up to bat in a World Series of high technology. We cannot just walk away from the stadium. We must stay to watch the game. Otherwise, we won't be able to tell if that loud "crack" comes from a home run or a broken bat. And cheering, alone, simply isn't enough. Business and industry can't just sit on the bleachers. We are all needed on the home team.

Schools need our help in two critical areas. First, help in preparing candidates for colleges and universities. Second, help in preparing graduates who can read, write, compute and who want to work in entry-level jobs or in the military. Schools, for many reasons, can become isolated from the world of work and the state of modern technologies. Digital is the second largest computer maker in the World, and because computers play such a key role in almost all fields, Digital has a special interest in computer literacy. We have dozens of relationships with high schools, community colleges and universities around the world built upon computer curriculum and equipment issues.

Three years ago, Digital centered into two very special computer education partnerships. One was in Boston, the other, in Oxford, Massachusetts, a small rural blue collar community. Both partnerships have prospered. Oxford was recently selected as one of five national N.D.N. Lighthouse Schools, based on its Prject COFFEE which Digital strongly supports. Oxford and Digital received a Presidential Citation for this partnering in October, 1982. I continue to enjoy working with the Dr. Frank Driscoll's Oxford team and their French River Teacher Center.

But my major time commitment is spent with the Boston Schools, at the Humphrey Center in Roxbury. In 1980 as I came aboard, the Center was preparing to open its $40 million plant to welcome 2,000 Boston students from 13 sending high schools. Digital was preparing to open a model innner-city electronic assembly plant in Roxbury, half a mile away which, incidentally, was recently visited by President Reagan on his trip to Boston. This geographic closeness was one reason top Digital executives met with then-Superintendent Wood to negotiate one-year trial executive-on-loan program between our firm and the Humphrey Center. They wisely left the relationship loosely defined.

As I prepared to become that loaned executive, my previous four years of industry-education experiences reminded me of some hard-earned lessons. I was told to find strategies to help the Center help the students and "to make a difference." I knew my first task was to try to bring focus to our efforts. My earlier work had taught me the value of objectives, charters and jointly-agreed upon strategies. Clearly, my role could only be consultant and not executive; after all, it was their School and not ours.

I brought in a process consultant, a specialist in educational systems planning and sponsored a retreat where the Center staff could define its mission, goals and create objectives that could become progress bench-marks. Now, three years later, this Key Results process is the Center's management system of choice. By now, everyone seems comfortable with the notion of planning and reporting Key Results in administration, curriculum, equipment and advisory committee functions.

Next, working with the Tri-Lateral Council for Quality Education, we established top-flight advisory committees for the eight programmatic clusters. These were, and are, socially-responsible professionals from Boston's businesses, labor leaders and community-based organizations.

Next, Digital provided computer equipment, word processing equipment, audiovisual courses and other resources valued at over $400,000 at no cost to Boston, But, we waited to deliver them until we had run awareness workshops with the Center for more than 60 teachers and administrators to help raise high tech and computer awareness. These in-service workships were like yeast; they have helped the system create its own cadre of computer-minded teachers and staff. We made our Corporate training center available for specialized technical instruction. We also brought in Digital people for occasional speaking and consulting engagements.

We linked the Digital-provided computer and word processors for use by community-based organizations who were working for gender and racial equity in computing access. For example, Roxbury Community College, MASSPEP minority pre-engineering program, and the Boston Indian Council have all been involved in a host of ways with, or at, the Humphrey Center.

The students at the Center learn entry-level data processing, data entry and word processing skills. Ninth graders gain an overview of computer awareness and first level literacy. The Data Processing mission statement is to prepare students for enty-level work or further training. We use computer-based guidance systems, computerized cognitive mapping, computerized basic skills remediation, and make our facilities available for several after-hours adult education programs.

Parallel with the evolving Center, the Director, Jim Caradonio, set up a superb to make computing available to other schools through an aggressive equipment acquisition and teacher training strategy. In 1980, Boston Schools offered computer experiences to only about 4% of its students. Today, because of Digital's computers and the outright purchase by the System of about 250 school microcomputers, nearly 10% of our students have access.

This year, the Director, his team, and I worked with the new Boston Compact and the Boston School Committee, the Superintendent and the Mayor to make an exciting goal the target of Boston's computer outreach. Our joint goal is to make meaningful computing experiences available to 100% of our students - in all Boston Schools - by 1987.

For a city with a 10-year history of implementation of the desegregation order, and a national reputation as a system in crisis, I find this imaginative new goal inspiring. Our new Superintendent Spillane has put together a very effective management team. Our business community and many dedicated community people and labor leaders have stepped forward to give this new Compact idea a real chance. The core idea is simply that the schools will provide employers with willing and able graduates. In return, the Compact business members will provide entry level jobs on a gradually increasing basis. The most enjoyable thing about my three years has been watching the quiet evolution of a new spirit; a can-do, will-do attitude around quality of education and computers.

Where did this new attitude come from? Partly from strong new leadership at the top. Partly from new initiatives by leading business people and the Mayor. And partly from their self-realization by Boston teachers and administrators that they are not technological peasants. Rather, I have found they are at least the equal of any professionals I have met in private business. The Compact, and many ohter initiatives in Boston may well prove that there can be a new spirit moving in America's urban schools. The proof will come when 6,000 students in 1986 find job openings and opportunities for further training available.

Beside the free-flow of viewpoints between schools and business, partnering can help schools in a set of graduated steps. Early linkages probably should be cautious and exploratory. A mutual trust develops, both sides will see new opportunities. Having a good planning process and model can help as projects become more ambitious. And a model such as Key Results can help clarify what those projects should be. And clearly, the business partner does not need to be high tech to have high impact.

There is enormous good will toward youth among business people. The equipment, procedures and technology they can bring to schools is just a material manifestation of caring and sharing. After all, that's what partnering really is all about, isn't it?

Mr. Przybylek. Yes, sir.

Mr. Gore. Mr. Goldberg.

Mr. Goldberg. We tend to deal through the service providers of our training programs. What we are looking for is prompt retraining and replacement of the individual in a new job, so we are looking for——

Mr. Gore. You do not look very far into the future?

Mr. Goldberg. No, we are looking for current local labor market demand for the individual—where he lives and where he or she is going to be employed. So we are not looking for long-term protections, at least not through this approach.

Mr. Gore. Next week.

Mr. Goldberg. Well, it would be wonderful if it would be next week. We tend to be very practical.

Mr. Gore. Yes.

Mr. Tuttle.

Mr. Tuttle. Well, I guess in our position, we do not have a very sophisticated way of projecting this, although we do try to project about 5 years.

Mr. Gore. 5 years.

Mr. Tuttle. 5 years. We do a considerable amount of talking to lead industries in trying to get the feel of where things are going in their industry so that we can adjust our training to it.

You hear so much about emerging jobs. There are not very many new emerging jobs. They are jobs that exist but the technology within the job changes. That is the real skill and the real challenge; trying to keep the education and the training changing as the technology changes.

You know, we still are turning out welders, but they are nothing like the welder was 10 years ago, because the kind of welding that is needed is completely different.

Mr. Gore. Mr. Odom.

Mr. Odom. I would really hesitate to answer your question except as a layperson from what I have read. I would say 5 to 10 years would be the outer limit of it. Ten years with what I have seen in the kitchen being cooked up would be a long time.

Mr. Gore. Yes. All right, 5 to 10 to 20.

Mr. Goldberg, what kinds of jobs are you retraining your people to perform?

Mr. Goldberg. For a displaced auto worker, it is dependent upon the location that he or she is in. Again, what we do is depend greatly on the service providers and the community college system, which we work closely with, and manufacturers associations, in identifying those trainings.

If I can give you an example of a differentiation between training. In one area in California where we are doing placement, we have set up a relationship with the Manufacturing Association. They have identified for us that only individuals with baccalaureates in computer programing are marketable in that area, as compared to another State where we found individuals with an associate of art's degree in programing are marketable. That has been our approach.

Mr. Gore. I see. So you do not have any one category that makes up—you just train people for all kinds of things.

Mr. **Goldberg**. It is dependent on what the labor market speaks to in a local area. It could be in property management; it could be in robotics.

Mr. **Gore**. Is it true that you trained one unemployed auto worker as a baseball umpire?

Mr. **Goldberg**. Yes, that is true.

Mr. **Gore**. Do you view that as a sunrise profession? I hope it is.

Mr. **Goldberg**. I think if the person is employed, it is a very successful training program.

Mr. **Gore**. The sun rises for him, then. All right.

Do any of you have a suggestion with respect to the computerized job bank? Mr. Tuttle spoke to it in his prepared remarks.

Do any of the other witnesses care to comment on that? Nationwide computerized job bank that the Congress has been trying to get the Labor Department to establish by coordinating all of the State data banks.

Mr. **Przybylek**. I will attempt a response. I think the Japanese have had it since 1960 or thereabouts. Again, I can recall a quote by Eli Ginsberg one time saying that "Manpower planning is almost," and I am paraphrasing, "the antithesis of our pluralistic society."

When I listened this morning to the testimony, I gave up a long time ago as to whether or not I would always have the hard data in front of me, and again, as the panelists mentioned here just recently, I find my best data—I look at the national trends, but I find my best data more or less going in a peripatetic fashion from company to company and looking at regional industrial development authority plans and things of that nature and doing the intelligence and then putting some kind of a plan together like that.

But I think if we have national mobilizations or if we have maybe certain industries, maybe some of that global information is necessary, maybe a nationalized computer job bank is necessary, but as a practitioner, I would not rely heavily on it.

Mr. **Gore**. Anybody else want to comment? No. All right.

How do we go about structuring and restructuring education for a lifetime of work if it is reasonable to assume that people are going to have to look forward to several different occupations during their lifetime? Clearly the current system of education first, then employment, no longer works efficiently.

What do we put in its place? Anybody want to tackle that one? Mr. Tuttle.

Mr. **Tuttle**. I think it still works if the education is for the right reason, but that is not the whole story. No one, including engineers, scientists, or bankers or a trades person can expect that training to last. They have clearly got to continue your education and update whatever it is they are doing or in a short time, they are going to be without skills.

Mr. **Gore**. Mr. Goldberg.

Mr. **Goldberg**. I would like to add to that. In the "professional occupations," we have all learned that Formal school education does not end; we go to undergraduate, graduate, then we attend seminars and continue increasing our technical knowledge and skills in our professions.

That kind of attitude, I think, has to be transmitted to the new skilled worker, the new blue-collar worker, that education is a continuing process all through their entire worklife, and so there has to be that relationship, that philosophical relationship developed between what has been in the professional classifications and what is currently being developed in the blue-collar classification.

Mr. GORE. Well, now hearings like this one are an attempt to retrain those of us in the Congress and give us some additional skills to tackle problems that we did not identify as problems in the past. I certainly want to thank all of you for helping us in that effort.

Did you have another comment, Dr. Przybylek?

Mr. PRZYBYLEK. I do not want to hold you, but I have maybe a little—my conceptions, my ideas are maybe a little different. I agree, we are in an era where lifelong learning is here, and everybody has to have a personal plan to maintain their current skill levels and I think almost everybody has to plan on going to school or participating in workshop at least one evening a week, whatever. But I think in terms of young people, what Mr. Tuttle was talking about, I think the education is going to get more and more general.

I think in terms of adult education, it is going to get more and more specific because I see many career readjustments in adult education. When you hire a young person, you oftentimes are looking at somebody with a general background, but when you are hiring an adult, you are looking for a specific skill.

I differ a little from the standardized thinking processes.

Mr. GORE. Well, thank you very much and thanks to all of you for rounding out the final panel of this 2-day hearing on a topic that is obviously going to be occupying much more of the Congress attention in the months and years ahead. It is obvious from the testimony that we have received for the past 2 days that the United States is right in the middle of a wrenching transition in its industrial base, in its pattern of job distribution.

If we are going to recognize a national responsibility to ease that transition, we have to focus on job forecasting and the link between job forecasting and retraining efforts like the ones that you gentlemen have done such a fine job with.

So thank you very much for your assistance in this hearing, and with that, the hearing will stand adjourned.

[Whereupon, at 12:50 p.m., the subcommittee was adjourned, to reconvene subject to the call of the Chair.]

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